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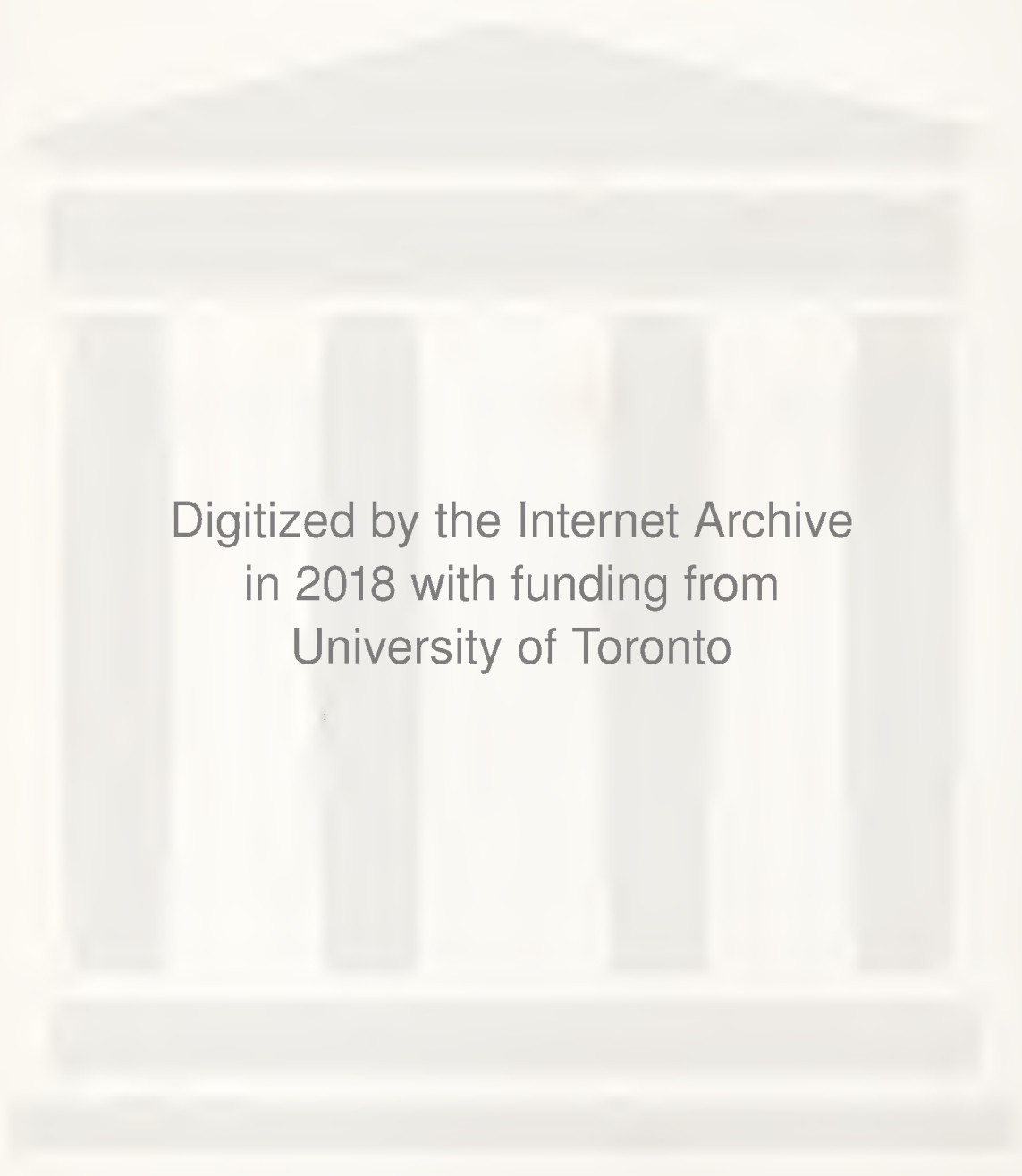
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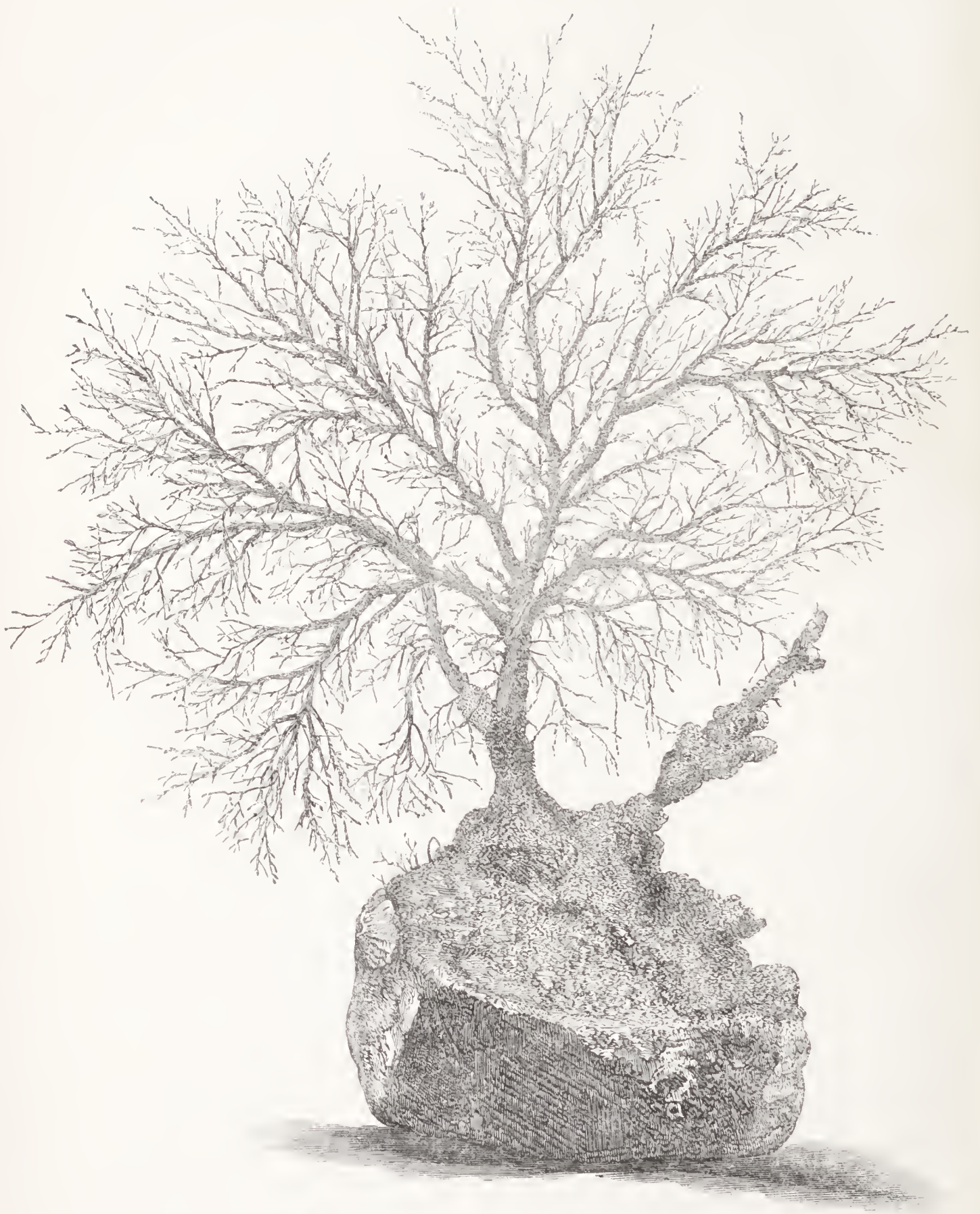
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BRITISH HYDROID ZOOPHYTES.

VOL. I.



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Eudendrium rameum, Pallas.

A
H I S T O R Y
OF THE
BRITISH HYDROID ZOOPHYTES.

BY
THOMAS HINCKS, B.A.

IN TWO VOLUMES.

VOL. I.—TEXT.

LONDON:
JOHN VAN VOORST, PATERNOSTER ROW.

MDCCCLXVIII.

“THAT which we foolishly call vastness is, rightly considered, not more wonderful, not more impressive, than that which we insolently call littleness.”—RUSKIN.

P R E F A C E.

It is not necessary that I should enter into any explanation of the causes that have delayed the publication of the present work, which was designed and announced several years since; but I should be ungrateful if I did not acknowledge the enduring patience of the Publisher under trials of no ordinary kind.

The appearance of this work cannot certainly be accounted premature. Twenty-one years have elapsed since the second edition of Dr. Johnston's 'History of British Zoophytes' was published; and during that period the whole aspect of his favourite science has changed. His classification of the Hydroida has long been in great part obsolete, while the number of known species has been almost trebled since he wrote. Like his predecessor, Ellis, he rendered in his day invaluable service to Zoophytology, and gave an impulse to the study of it, of which we are now reaping the fruits. It should be added that there is a charm in his work, which does not become obsolete with its science; it

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will always rank, with the 'Corallines' of Ellis, amongst the classics of natural-history literature. As a manual for the use of the student, however, it has long ceased to be of value; nor is there any work in existence that contains a complete account of the British Hydroida. The place therefore is vacant, which the present work aspires to fill. I have endeavoured to make it a full and faithful exposition of our present knowledge, and to do for the students of this day what Johnston's 'History' accomplished for those of his own generation. It is certainly time that the remarkable results attained since he wrote, and now widely scattered, should be presented in a connected form and made available for general use, and that the difficulties should be removed which interfere with the cultivation of one of the most delightful branches of Natural History.

This Preface might have been very brief, had not the kindness of many friends and fellow workers laid me under heavy obligations, which it is a duty and a pleasure to acknowledge; without such cooperation, indeed, I could not have accomplished my work. Foremost amongst those to whom I have been indebted for help, it is right that I should place my lamented friend the late Mr. Alder, one of the ablest of British naturalists, and one of the most amiable and upright of men. In the course of a long correspondence, extending over many years, and relating chiefly to our favourite studies, I have had the opportunity of profiting largely by his extensive knowledge,

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accurate observation, and sound judgment. During the preparation of this work I have had the benefit of his valuable opinion in many cases of difficulty, and have often been materially assisted by his cautious wisdom and remarkable skill in the discrimination of species. His collection was freely placed at my service; and many of the figures with which this work is enriched are engraved from his admirable drawings.

To Mr. Busk I am under peculiar obligations for much valuable counsel and practical aid, and especially for his kindness in placing at my disposal his large and interesting collection of foreign Hydroida and an extensive series of drawings.

To my friend Prof. Allman I owe my warmest thanks for the readiness with which, out of his large stores of knowledge, he has communicated information that I happened to need, or favoured me with his views on doubtful points. I am also indebted to him for drawings of some of the species which he has discovered. The reader of this work will understand how much I, in common with all zoophytologists, owe to his writings.

Dr. Strethill Wright has rendered me most important service by permitting me to reproduce the figures which illustrate his valuable papers, and by freely communicating to me his views on some of the most interesting questions in zoophytology.

To the Rev. A. M. Norman I am indebted for the use of the late Mr. Barlee's collection of Hydroida, including many Shetland acquisitions, and for the

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opportunity of examining specimens obtained by himself in the course of his extended dredgings.

Mr. J. Gwyn Jeffreys has kindly supplied me with a quantity of zoophytes procured during one of his famous Shetland cruises, amongst which were one or two most beautiful species new to science.

Mr. C. W. Peach, who was a valued contributor to Dr. Johnston's 'History,' and who is an enthusiastic worker still, has come to my assistance with an ample list of habitats, and has also contributed some interesting specimens.

My acknowledgments are further due to Professor Wyville Thomson for some exquisite drawings which have been engraved for this work ; to Dr. Collingwood for a list of the zoophytes found in the neighbourhood of Liverpool, and notes on some of the species ; to my friend Mr. E. W. H. Holdsworth for his interesting observations on *Cladonema* ; to Mr. George Hodge for the use of figures and the communication of specimens ; to Mr. Leipner for some very skilfully mounted specimens of Campanularian and other zoophytes ; and to Mr. G. S. Brady for Hydroida obtained in Connemara.

I have also to thank Professor Sars and Professor Van Beneden for their great courtesy and kindness in forwarding to me copies of their publications.

In the preparation of the plates I have had the zealous cooperation of Mr. Tuffen West, who has spared no pains in the execution of the engravings, and whose practical acquaintance with the subjects delineated,

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combined with his well-known artistic skill, has enabled him to produce a most satisfactory result.

One point in the work itself requires a word of explanation. It has been impossible, from the very nature of the objects treated of, to make the specific descriptions as brief as I could have desired. I have therefore printed in Italics the leading and distinctive characters, so that the peculiarities which separate each species from others may be recognized at a glance.

I trust that this work may facilitate the study of one of the most charming branches of Natural History, and so tend in its degree to foster a taste which, I can testify from experience, is an unfailing source of delight, and affords the most welcome relief and refreshment amidst the cares and harder duties of life.

T. H.

Great Malvern,
November 20th, 1868.



Plumularia halceioides (young).

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INTRODUCTION.

A GENERAL sketch of the structure of the Hydroida, and the history of their reproduction and development, is a fitting prelude to the study of our British species. It would be impossible, in a systematic work like the present, to discuss at length the many interesting and difficult questions that meet the student in this province of zoology. It will rather be my aim to convey an accurate idea of the form of structure that characterizes this group of animals, and of the striking facts of the Hydroid life-history.

As a preliminary, it will be necessary to define the descriptive terms employed in this work.

TERMINOLOGY.

I have endeavoured to simplify in this department as much as is consistent with precision, believing that a cumbersome and difficult terminology is the bane of science. As uniformity of practice is clearly desirable, and much confusion arises from the use of terms in different senses, I have made only those changes that seemed to be absolutely necessary, and have adopted the terms that have obtained most currency in the higher literature of the subject.

A precise terminology is no doubt of great value; but

to burthen technical language with a multitude of harsh-sounding Greek compounds is to check, and not to aid, the cultivation of science. The aim should be to combine definiteness with simplicity, as far as possible.

The following List includes the principal terms with which the student of the Hydroida should be familiar :—

ZOOID.—Any one of the principal elements, more or less independent, that make up the complex individuality of the zoophyte,—*e.g.* the polypite, the reproductive body, whether fixed or free, &c.

POLYPITE.—The alimentary or nutritive element of the Hydroid colony, consisting of a digestive sac, with a terminal opening (mouth) and organs of prehension (tentacles). Occasionally the adult zoophyte consists of a single polypite, as in *Myriothela*, *Corymorpha*, and *Hydra*; but generally a large number, the product of successive buddings, are organically united, so as to form a composite and plant-like structure.

CÆNOSARC.—The common flesh or trunk, which unites and binds together the polypites in a compound zoophyte. The following parts must be distinguished in it :—the *stem*, which is sometimes simple and sometimes branched, and the *adherent base** or *stolon*, which roots the zoophyte to the surface on which it grows. The latter is generally filiform and reticulated; but in some cases it occurs as a solid, chitinous crust (*Hydractinia*).

POLYPARY.—The chitinous† sheath or tube which encloses

* The former of these is the *hydrocaulus* of some writers, and the latter the *hydrorhiza*.

† Chitine is a substance resembling horn, but differing from it in chemical composition.

the cœnosarc, to a greater or less extent, in all (?) the fixed Hydroida. It varies in the degree of development, sometimes investing the whole of the cœnosarc, and sometimes only a small portion of it. It usually forms a solid covering, but in some cases is a mere membranous film.

HYDROTHERCA or CALYCLE.—The chitinous receptacle in which the polypites are lodged in one of the Hydroid suborders (*Thecaphora*). The term *cell* has been commonly applied to this portion of structure; but as this word is now generally used in physiological science with a totally different meaning, it will be more convenient to dispense with it here.

GONOPHORE.—The bud in which the reproductive elements are formed. It consists of an external envelope (ectotheca), enclosing either a fixed generative sac, between the walls of which the ova and spermatozoa are developed, or a free sexual zooid*.

GONOOID.—The sexual zooid, whether fixed or free; the gonophore *minus* the ectotheca. In some genera (e. g. *Clavatella* and *Corymorpha*) the gonozoids are destitute of an ectothecal covering at all stages of their development.

* A somewhat different meaning is given to the term gonophore from that which it bears in the works of Prof. Allman, by whom it was introduced. A little uncertainty, it seems to me, connects itself with his use of the word. He has defined the gonophores to be "certain buds of a peculiar structure, destined for the formation and protection of the generative elements." Of these buds an ectotheca or protective envelope is, in a large proportion of cases, an essential part; and the contained sexual zooid, when free, makes its escape from this outer sac, which then withers away. Now, as employed by Allman, the gonophore is sometimes the reproductive bud *with its ectotheca*, and sometimes the contained zooid, whether fixed or free. To me the gonophore is the whole bud, and the sexual zooid developed in it, whether as a fixed sac or a floating polypite, is the *gonozoid*.

SPOROSAC.—The generative sac.

GONOTHECA or CAPSULE.—The chitinous receptacle, within which the gonophores are produced, in the sub-order *Thecaphora*.

CORBULA.—The protective case which shelters the reproductive capsules in the genus *Aglaophenia*. (Woodcut, fig. 37, page 308.)

UMBRELLA or SWIMMING-BELL.—The contractile disk, by means of which the medusiform gonozooid propels itself.

MANUBRIUM.—The hollow body terminating in a mouth, which is suspended from the top of the umbrella, and hangs free in its cavity.

VELUM.—The delicate membrane which partially closes the opening of the swimming-bell.

LITHOCYSTS.—Small sacs developed on the margin of the swimming-bell, in certain genera, and containing refractile spherules. They are probably organs of sense.

PLANULA.—The usual form of the Hydroid embryo.

TROPHOSOME.—The whole company of alimentary zooids associated in a Hydroid community.

GONOSOME.—The sexual zooids of the community.

ECTODERM.—The external membrane or layer of the body-substance amongst the Cœlenterata.

ENDODERM.—The internal layer of the body-substance.

NEMATOCYSTS or THREAD-CELLS.—Minute sacs imbedded in the body-substance containing delicate projectile threads.

PALPOCIL.—A rigid, hair-like process, occurring on the tentacles of some of the Hydroida, and probably an organ of touch.

THE HYDROID COLONY.

In a few cases the adult Hydroid consists of a single polypite; but generally many are organically united and form a colony or community. Associated life is the rule, and solitary existence the rare exception. Amongst the animals that compose the present order gemmation is universal, and by successive buddings the complex plant-like structure is rapidly evolved from the primary polypite, which is the product of the egg. Even in *Hydra*, which is a solitary being, the vegetative power is active; but the buds, which are produced in profusion, are thrown off instead of being retained in permanent connexion with the parent stock.

The Hydroid colony, which may include its thousands of polypites, as well as a large company of reproductive zooids, is the result, like the tree, of a continuous process of budding, and, whatever its extent, has originated in a single polypite. The analogies, indeed, between zoophyte-life and plant-life are numerous and striking; and we shall best illustrate and explain many points in the history of the Hydroida by a reference to the facts of the vegetable world.

Every Hydroid colony consists of two parts (which may be considered separately)—the cœnosarc or common connecting substance, and the zooids held in organic union by it, which discharge different functions in the service of the commonwealth.

The cœnosarc is a fleshy tube (a thread of animal substance hollowed out in the centre) which now appears as

a trailing fibre adherent to some body and rooting the whole colony to its place, now as a simple or branching trunk supporting the zooids, and multiplying and renewing them. It is composed of two layers, an outer (ectoderm) and an inner (endoderm), which enter into every portion of the structure. The endoderm lines the whole of the body-cavity, and is chiefly concerned with nutrition: the ectoderm is much more susceptible of modification, and gives rise to many important structures. Between these two primitive layers a third is sometimes interposed, described by Allman and Wright as a muscular coat, composed of longitudinal fibres, and by Reichert as "a supporting lamella—a sort of inner skeleton." It has been observed in the body of the polypites, and, if muscular, will explain the rapidity with which they retract themselves*. In most cases the cœnosarc is partially or wholly protected by a chitinous covering (polypary), which is a secretion from its outer layer. In many families the polypary invests the whole of the soft animal substance, and expands into elegant cups or calyces around the body of the polypites; and we have thus a cast of the composite structure in chitine, which, in the disposition of its parts and its general aspect, bears a close resemblance to a plant.

In other families the polypary is less developed, merely investing the stolonie network and the base of the polypites, or also clothing the trunk and branches, but never forming a true calycle. The *Hydra* alone, if we except the

* *Vide* a paper by Dr. T. Strehill Wright on *Hydractinia echinata*, Edinb. N. P. Journ. N. S. for April 1857, paragraph 21. Also a paper by Reichert in the 'Monatsbericht der Akad. der Wissenschaft. zu Berlin' for July 1866.

For the histology of the Hydroida, the student should consult Kölliker's 'Icones Histologicæ,' part ii.

floating members of the order, is totally destitute of a polypary.

Through the tubular cavity of the cœnosarc the nutrient matter, elaborated within the stomachs of the polypites, circulates, reaching every portion of the structure and supplying the elements needed to maintain the health and growth of the whole.

The circulation is of the simplest kind : a stream, bearing along with it a multitude of restless granules of various sizes, issues from the stomachs of the polypites and rushes through the cavity of the cœnosarc, pervading every portion of the organism. After flowing downward for some time, there is a pause in the circulation, and then the current rushes back with great impetuosity, and, once more entering the stomachs of the polypites, mingles with the contents. A busy ferment takes place for some seconds in the digestive sac, the larger particles hurrying to and fro amidst the contained mass of food, until at length the efflux again commences. The inner surface of the cœnosarc is covered with vibratile cilia, and these seem to be the chief agents concerned in maintaining the flow of the currents.

Within the buds, which pullulate at certain points from the common substance, and are developed into new polypites, there is always a great aggregation of the nutrient particles and a remarkable activity amongst them. They crowd the cavity of the nascent polypite, and supply, as it were, the building-material that is needed for the extension of the structure.

The cœnosarc of the zoophyte may be likened to the trunk, branches, and roots of the tree, regarding the latter merely as a means of attachment to the soil. The zooids which it supports and binds together in one organic whole

may be compared with the leaf-buds and flower-buds of the plant.

There are two principal classes of them—the nutritive, or those which are concerned in obtaining and preparing food for the commonwealth, and the reproductive, which are charged with the propagation of the species.

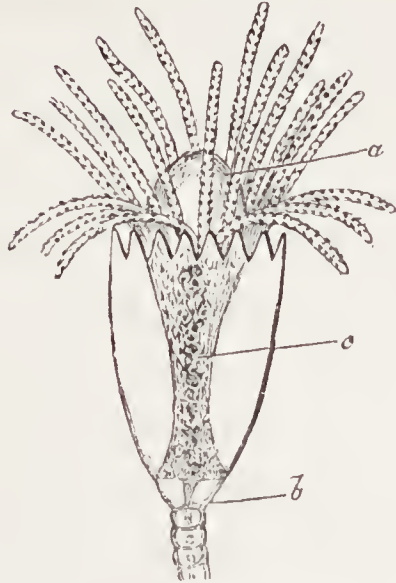
The polypite or alimentary zooid, though varying in form and colour, and in the arrangement of the prehensile organs with which it is furnished, is always identical in essential structure with the *Hydra*, the type of the class Hydrozoa. It consists of a soft contractile body, very mutable in shape, the walls of which are composed of the same elements as those of the cœnosarc, and are, indeed, a continuation of them. The interior is occupied by the digestive cavity, which is not a distinct bag or sac, but a mere hollow scooped out, as it were, in the body-substance. At its upper extremity it terminates in an oral opening; and below it communicates freely with the general cavity of the cœnosarc, and lies open to the nutrient currents that pervade it. In some families (e. g. *Campanulariidae*) the base of the stomach is connected with the common canal traversing the stem by a narrow tubular passage, the “transition-piece” of Reichert*. (Woodcut, fig. i. b.)

The oral aperture is simple or somewhat lobed, and is commonly borne on the summit of a more or less prominent proboscis, which is capable of great elongation and contraction and is remarkable for its mobility. In some genera the proboscis is conical, in others it is trumpet- or funnel-shaped. Amongst the *Eudendriidae* and *Campanu-*

* *Vide* a paper “On the Contractile Substance and Intimate Structure of the *Campanulariæ*, *Sertulariæ*, and *Hydriæ*,” by Prof. Reichert, Monatsbericht der Akad. der Wissenschaft. zu Berlin, July 1866. Translated by Dallas, Ann. N. II. for January 1867.

lariidæ it takes the latter form, and is a very conspicuous feature. (Woodeut, fig. i. *a*.) It is continually changing

Fig. i.



its shape, now enormously distended, now flattened down and with the lips thrown back, so as to form a saucer-like disk, now opening and closing rapidly, but never long the same. It is an admirable instrument, in conjunction with the tentacles, for the selection and prehension of food. In some Hydroids there is a marked constriction at the base of the proboscis; and in the curious genus *Ophiodes* (Hincks) the body is divided by a depression a little below the tentacles into two regions, a pharyngeal and gastric. Reiehert distinguishes the *narrow* between the proboscis and the stomach as “the œsophageal passage.” In general, however, the structure of the digestive sac is perfectly simple, and no defined “regions” can be recognized.

Within the stomachs of the alimentary zooids the food is digested and prepared for the nutrition of the whole structure. The polypites are the feeders of the commonwealth, and the unceasing activity of many thousands of them in the larger species is engaged in keeping up the necessary supplies.

The tentacles or prehensile organs are ranged round the oral extremity, or variously distributed over the surface of the body. They are filiform appendages, more or less extensile, and always bear a formidable armature of thread-cells, which are often aggregated in prominent groups, so as to roughen the surface, or to give it a beaded appearance.

The tentacle of the Hydroid is a tubular extension of the wall of the body, and communicates at the base with its cavity. In some cases, as in *Hydra*, it seems to be a simple tube, open throughout, in which the fluids circulate freely; but generally the cavity is more or less obliterated, and the tentacle presents the appearance of being septate, and partially filled up by a cellular axis.

In two of the suborders under which the Hydroida are ranged, the tentacles are disposed in a single wreath or circle, which surrounds the base of the proboscis, and are simply filiform; but amongst the *Athecata* they exhibit considerable variety both of form and arrangement. They are sometimes scattered over the body of the polypite, in some cases there is a slight tendency to a spiral arrangement, in others they are placed in two remote circles, and in one species, at least, their number is reduced to two. Amongst the *Tubulariidae* a large number of very short arms immediately surround the oral extremity, and a wreath of long slender tentacles encircles the base of the body. In many species these organs are arranged in two approximate series, one immediately behind the other, so closely set as to appear like a single circle.

In this suborder the tentacles are either slightly clavate or capitate, or simply filiform. In some genera the capitate and filiform kinds are both present.

The capitac tentacle, of which we have good examples in *Coryne* and *Clavatella*, bears on its summit a globular head, consisting of a collection of thread-cells—a formidable battery of offensive weapons, which is brought to bear on any passing prey. The arm is also endowed with vigorous percussive power, and when its numerous poisoned threads are brought into play, it can hardly fail to arrest and paralyze any of the smaller creatures that may come within its range. (Plate VII. fig. 1 *b*.)

The thread-cells, which bear so important a part in the Hydroid economy, exhibit many modifications. They occur in the ectodermal layer, and are present in astonishing profusion, not only on the tentacles, but in other portions of the structure. They consist of minute sacs imbedded in the flesh and filled with fluid, which contain a long and delicate thread, capable of being projected with considerable force and inconceivable rapidity. These threads bury themselves in any soft substance against which they may be directed, and, it is supposed, convey into the wound which they make some poisonous fluid.

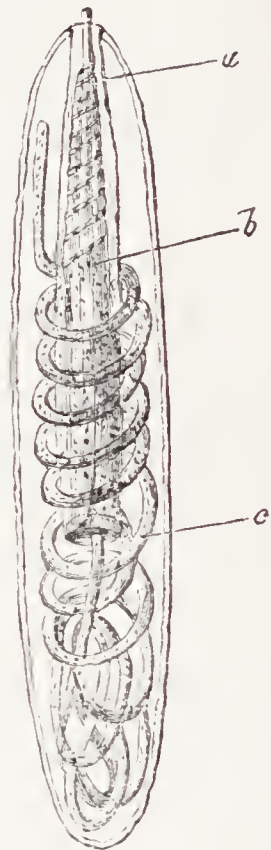
The thread-cell is a most interesting piece of structure. The long dart which it encloses is borne on a continuation of the inner wall of the sac (the “sheath” of some writers, the “axial body” of others), which is often covered with barbs. (Woodcut, fig. iii. *a*.) When retracted, the thread is spirally coiled within the cell and sometimes wound round the sheath. (Woodcut, fig. iii. *c*.) Two kinds of thread-cell are often met with on the same species. Besides the formidable instruments with which the tentacles are armed, large bean-shaped cells are sometimes crowded together in immense quantities, as, for example, in the ectoderm of the coenosarc in *Hydranthea*, and in the outer covering of

its gonophore. It is difficult to imagine what relation these can bear to the economy of the animal.

Fig. ii.



Fig. iii.



Groups of these bean-shaped cells are also present on many of the tentacles of the latter zoophyte, a little above the base, and form a beautiful ring of prominent pearly bosses.

Besides the thread-cells, the arm of the Hydroid bears another organ, which has been named by Dr. Wright the palpocil, and which is connected, no doubt, with the sense of touch. It consists of a long and delicate spine, springing from a small bulb, which is buried in the ectoderm. These palpocils or sensitive hairs are scattered over the tentacles in many species, and over other portions of the body, and must aid the capture of prey by giving instant notice of the presence of any animalcule or other small creature that may brush against them. It may be their function to rouse the thread-cells into action.

Besides the ordinary tentacles, peculiar appendages occur in two genera, *Cladonema* (Plate XI. fig. 2) and *Stauridium* (Plate XII. fig. 1), which I have named *false tentacles*, and which seem to discharge the function of tactile organs. They are filiform processes, standing out in a single series, near the base of the body at some distance below the arms, and at first sight might be taken for tentacles deprived of their capitate extremities. They are, however, perfectly rigid, and the tips at least are thickly covered with the sensitive palpoils. It seems to be their office to warn the polypite of the presence of prey, for if one of them is touched by an animaleule in its course, the body is immediately bent towards it, and the tentacles are brought into play.

In a few species the tentacles are united for a portion of their length by a very delicate membranous web. In *Ophiodes* (Plate XLV. fig. 2 *b*) it is well developed, and forms a rather deep cup enclosing the proboscis. In this genus it is armed with small clusters of thread-cells, which are set round it, one in each of the spaces between the tentacles, like so many batteries, and can discharge on the shortest notice a multitude of poisoned darts. It is very interesting to see the threads cast forth beyond the tips of the tentacles, and waving about in all directions amongst them, as if prepared to act with them in seizing and disabling their prey.

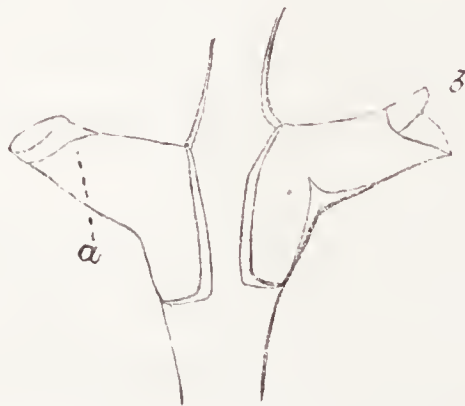
The intertentacular web is of rare occurrence, and is generally very slightly developed; but it has a special interest as the homologue in the polypite of the swimming-bell in the free sexual zooid.

Amongst the *Thecaphora* the polypite is protected by a calycul (Woodeut, fig. i.), within which it shelters itself by

contracting the body and tentacles, and folding the latter together. When in pursuit of food, it stretches itself beyond the opening of its little dwelling, and expands its wreath of milk-white arms, the starry blossom, as it were, of the animal-plant.

The calyces take the most graceful forms, resembling little chalices or vases, and are often decorated with crenated or castellated borders. In many species the aperture is furnished with an operculum, which opens to allow of the passage of the polypite, and closes on its retreat. It is a simple but very effective contrivance, and exhibits two or three principal modifications. In some cases the margin of the calyche is cleft into a number of pieces, which converge and meet in a point, and form a more or less conical lid. (Woodcut, fig 19, page 178.) In others, the cover is a membranous extension of the walls of the calyche, which falls into plaits or folds when the polypite withdraws, and so roofs over the opening. Amongst the *Sertulariidae*, the operculum presents another and a very interesting form, which has its exact parallel amongst the Protozoa. It consists of a plate or valve placed within the

Fig iv.



calyche, a little below the orifice, which is attached to the interior surface on one side and seems to be a continuation

of its inner layer, and which shuts down over the polypite in a slanting position when it withdraws itself. When the polypite emerges, it slowly pushes the valve back and keeps it erect so long as it is exerted: on its retreat, which is as quick as light, the lid flies back to its place. (Woodeut, fig. iv. *a*, the opereulum elosed; *b*, ditto open.)

Dr. Wright has described a similar structure as occurring in the beautiful Protozoan *Vaginicola valvata**; and amongst the terrestrial mollusea it has its analogue in the *clausium* of the genus *Clausilia*. In some species the opereulum seems to be a simple piece attached to the margin at one side by a kind of hinge, which falls down over the orifice like the lid of a box.

The life of the polypites is by no means commensurate with that of the zoophyte. They frequently perish from various causes—falling, in some cases, like leaves, in others being absorbed into the substance from which they sprung; while the *cœnosare* retains its full vitality, and, in time, will bud forth a fresh erop. When the polypite is undergoing the process of absorption, an extraordinary ferment is visible in its digestive sac; the granules contained in the nutrient stream are seen to be as actively at work as when a new portion is being added to the organism, moving restlessly about within the cavity, then hurrying from it, and soon reentering it, until the materials of the body have been, as it were, broken up and borne away to be wrought into fresh structures.

Dr. Wright has observed, in the case of *Hydractinia*, that in the winter the *cœnosare* often exists in a high state of development, while the polypites are few in number

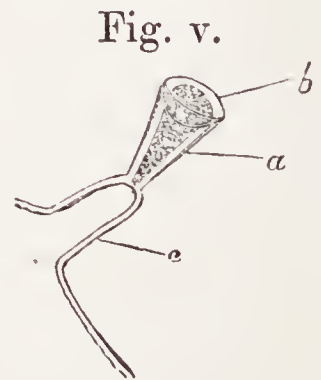
* "Description of New Protozoa," Edinb. N. P. Journ. N. S. for April 1858.

or altogether absent, and only reappear with the return of spring. This condition may remind us the of winter rest of the plant.

Besides the polypites, which are essential parts of every zoophyte, special appendages of the cœnosare are met with in some species. Amongst these must be placed the curious structures which have been named "nematophores" by Mr. Busk, and which are characteristic of the family *Plumulariidae*. They consist of an extension of the polypary, which may be tubular, or eup-shaped, or conical, open at the upper extremity, and enclosing a granular mass, in which large thread-cells are sometimes imbedded. They may be classified as simple or compound, sessile or pedunculate. The simple nematophore is a chitinous tube or eup, consisting of a single chamber. The compound nematophore is bithalamic, having a slender tubular portion below (Woodcut, fig. v. *a*), and expanding above into a hemispherical eup (Woodcut, fig. v. *b*). It is attached at the base only, and free throughout its length; whereas the simple nematophore is generally to a considerable extent adnate to the calycle or stem.

The pedunculate form (Woodcut, fig. v.) I have only met with on *Plumularia Catharina*. In this species the pair of lateral nematophores connected with the calycle are mounted on peduncles, by which they are raised to about the level of the rim. They are of the bithalamic type. The other nematophores, which are profusely distributed over this beautiful species, are sessile.

Good examples of the simple tubular form are afforded by *Aglaophenia pluma* (Woodcut, fig. vi.) and *A. tubulifera*.



Simple cup-shaped nematophores occur on *Plumularia pinnata*, while those of *P. setacea* and some other species of this genus and of *Antennularia* are bithalamic.

The nematophores occur on various parts of the zoophyte, and are usually present in force about the hydrotheca. They are met with over all portions of the stem and on the creeping fibre; but the most remarkable aggregation of them is found on the *corbula*, or case that protects the gonophores in the genus *Aglaophenia*, where every tooth on the crested ribs is formed by one of these curious bodies*.

The contents of the nematophore have been recently investigated by Prof. Allman†; and to him we owe the important observation that the soft granular mass which fills it “has the power of emitting very extensile and mutable processes,” that comport themselves in every respect like the pseudopodia of an *Amœba*, which they also resemble in their structure. These processes “consist of a finely granular substance, which undergoes perpetual change of form;” and “they can be entirely withdrawn, so as to leave no apparent trace of their existence”‡. (Woodcut, fig. vi.)

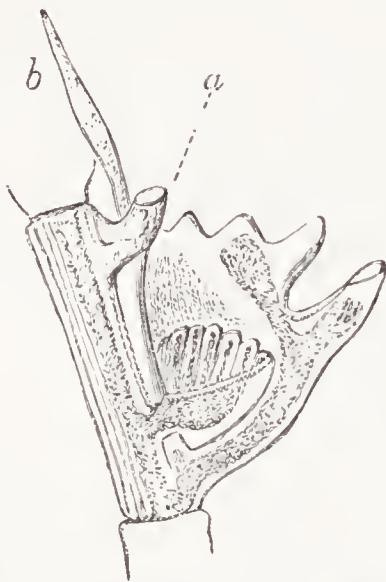
* Prof. Huxley, in a paper “On the Anatomy and Affinities of the Family of the Medusæ” (Phil. Trans. 1849, p. 427), in which, I believe, we have the first notice of the nematophore, has described a form occurring in a foreign species of *Plumularia* as consisting “of a stem proceeding from the pedicle of the ovary, bearing a series of conical bodies.” This evidently corresponds with the spur-like process found at the base of the corbula in our own *Aglaophenia tubulifera*, and is nothing more or less than a supernumerary rib or “leaflet,” edged, as all the elements of the corbula are, with nematophores.

† “On the Occurrence of Amœbiform Protoplasm, and the Emission of Pseudopodia, among the Hydroida,” Ann. N. H. for March 1864.

‡ The substance of the body amongst the Hydroida really differs but slightly from that of the Protozoa. True it is differentiated into distinct

I have made similar observations on *Plumularia setacea* and *P. frutescens*. On a young specimen of the latter species obtained at Oban the nematophores were in a state

Fig. vi.



The calyx of *Aglaophenia pluma*. *a*. The lateral nematophore. *b*. The extensile process.

Fig. vii.



of great activity, sending out long filamentary processes, which tended some upwards and some downwards, following the course of the stem and branches, and completely investing the zoophyte with a multitude of gossamer-like threads. (Woodcut, fig. vii.)

It has been conjectured that the nematophores are organs of offence. But this is hardly probable, as they only contain thread-cells in some cases, and when present

layers; but the ectoderm is of the simplest homogeneous texture—a structureless contractile substance, not unlike “sarcoderm” in any essential particular; and the soft masses contained in the nematophores seem to be ectodermal offshoots, somewhat less consolidated than the layer from which they originate.

it would seem that these organs are not carried out in the processes. Their number and the power which they possess of completely investing the zoophyte with their extensile threads would seem to show that they bear an important relation to the economy of the animal. They may be concerned in the nutrition of the colony; but without further observations we can form no certain opinion respecting their function*.

In the genera *Hydractinia* and *Podocoryne*, which approach the *Siphonophora* in complexity of structure, some curious appendages occur in addition to the alimentary polypite. We have first the spiral bodies, described under *Hydractinia echinata* (p. 24), which are developed on the edge of the common base or crust, round the mouth of the shell that supports the colony. They are remarkable for the energy with which they uncoil and twist themselves about when called into action. They usually form a somewhat dense fringe round the mouth of the shell (which is almost always tenanted by a Hermit-Crab), and are roused from their state of quiescence by anything that may irritate the surface of the cœnosarc. As they are well armed with thread-cells they may be regarded as organs of offence, though it is difficult to understand how they can act very effectively against the enemies of the commonwealth.

The other appendages referred to are long and extensile filaments that spring from the surface of the cœnosarc in certain portions of the colony, like the tentacles of *Veilella*, and which Dr. Wright regards as fishing-lines,

* In the account of *Hydractinia echinata* (p. 25) I have treated the nematophores as offensive organs; but since this passage was written I have come to the conclusion that this is probably not their function.

enabling the zoophyte to seize food scattered about on the ground by the Crab when feeding*.

Perhaps the most extraordinary of the cœnosarcal appendages met with amongst the Hydroida are the snake-like organs with which the genus *Ophiodes* is furnished. (Plate XLV. fig. 2 a.) One of them is always stationed close to the polypite, and great numbers are distributed upon the creeping stolon. They are vigorous in their movements, capable of enormous elongation, and surmounted by a large capitulum, thickly covered with thread-cells. They may act not only as organs of defence, but also as auxiliaries in the capture of food.

The Hydroid colony is enlarged by a purely vegetative process : fresh polypites bud rapidly from the prolific pulp ; and in the larger and arborescent kinds branches and branchlets germinate, according to the pattern of the species, from the zoophyte as from the tree. For the multiplication and diffusion of the species, special zooids are set apart ; and to them is allotted the reproductive function, as to the polypite that of nutrition. They correspond with the flower-buds of the plant.

REPRODUCTION.

The polypites, or feeders, of the Hydroid colony are almost always present ; the sexual zooids are developed at certain seasons only, in buds of peculiar structure, which occupy different positions in different species. Amongst

* Allman regards these filaments "as an abnormal state of the ordinary polypite," and states that they are not usually present. But on examination they are found to bear the closest resemblance to a tentacle, being slightly enlarged towards the tip, and endowed with extraordinary extensibility. They occur both on *Hydractinia* and *Podocoryne carnea*, and, I believe, are very generally present, though when contracted they are with difficulty recognized.

the *Thecaphora*, these reproductive buds are always borne on an offshoot from the cœnosarc, which is enclosed in a chitinous receptacle or urn (gonotheca). (Woodcut, fig. xv.) In the suborder *Athecata* they are never protected by a true gonotheca, though in some species they are encased in a thin coating of chitine. In this division they occupy very various positions. Sometimes they are developed irregularly amongst the tentacles of the ordinary polypite (*Coryne*), or at different points on the body (*Clavatella* and *Podocoryne*); in other cases they occur on the cœnosarc (*Perigonimus*), while in *Tubularia* and its allies they germinate at the base of the lower circle of tentacles. In other cases, again, they are borne on special zooids, which are evidently polypites more or less atrophied and deprived of some of their characteristic parts. The atrophy varies in degree: sometimes it shows itself in a reduction of the number of tentacles; sometimes these organs are represented by mere clusters of thread-cells (*Hydractinia*); sometimes they are altogether wanting (*Cionistes*), and the polypites become nothing more than a columnar offshoot from the cœnosarc, closely resembling that which bears the gonophores within the capsule of the *Thecaphora*. The zooid (whether modified or not) which carries the reproductive buds may be designated the fertile or proliferous polypite*.

In *Hydra* the reproductive buds are developed within definite regions on the body of the polypite, and are generally produced when the ordinary gemmation has altogether ceased, or is beginning to fail. (Woodcut, fig. 40, p. 313).

The gonophores exhibit many modifications; like the

* The modified polypites whose function it is to originate the sexual buds, and which take no part in the nutrition of the colony, are the *gonoblastidia* of Huxley.

flower-bud of the plant, they have their many forms and even colours. If we examine their structure we find that the apparent differences amongst them are numerous and striking; but a closer investigation shows us that, amidst all the deviations, a community of plan may be traced.

The sexual bud consists (almost universally) of an outer investment (the ectotheca), which serves as a protective case, and a contained zooid, which may be male or female, and which originates sooner or later the generative elements. The two sexes are sometimes borne on the same colony, but more commonly the zoophyte is dioecious. The cases, however, are much less rare than had been supposed, in which both the male and female are mingled on the same shoots. The *Hydra* is sometimes monœcious and sometimes diœcious, the true representative of its Order in this as in so many other points.

The sexual zooids are either fixed or free. They either continue attached and mature and discharge their contents *in situ* (Woodcuts, figs. viii. and ix.), or at a certain

Fig. viii.

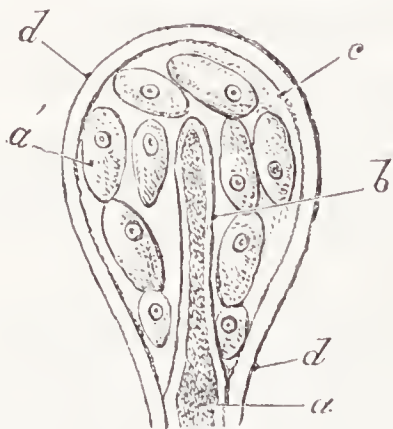
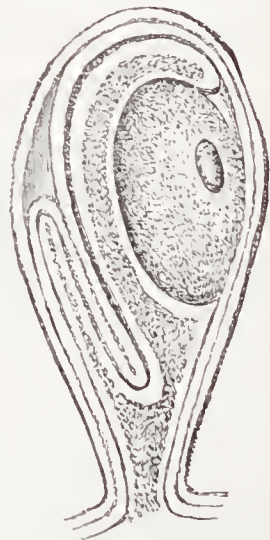


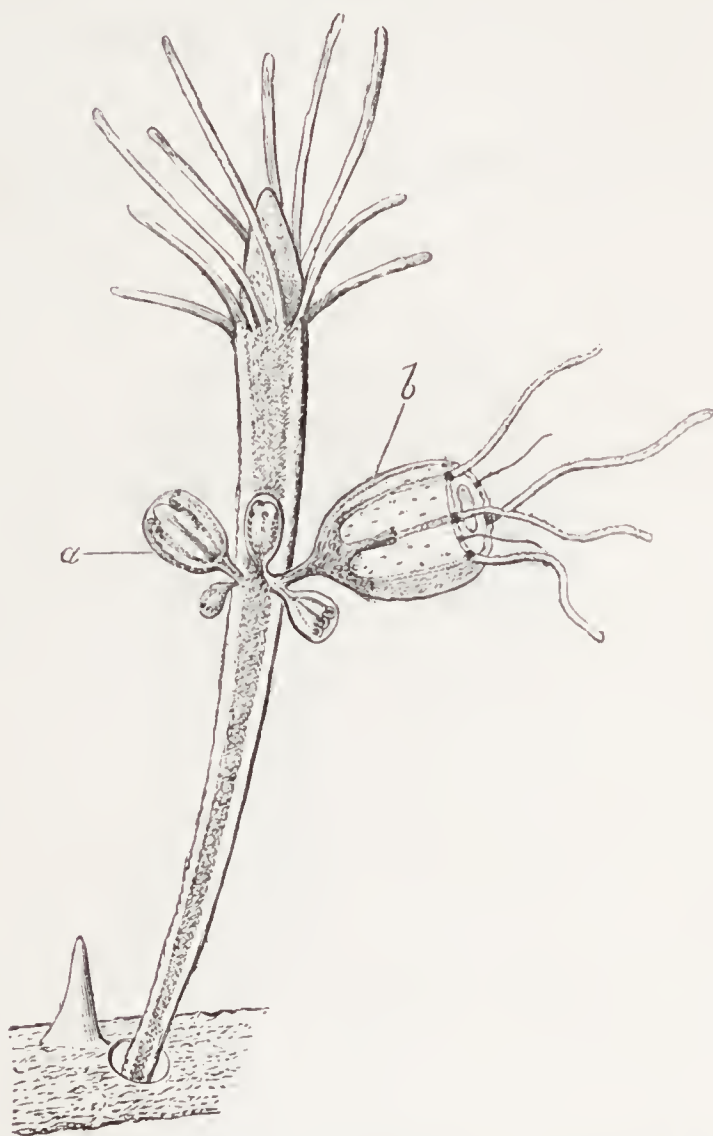
Fig. ix.



VIII. The gonophore of *Clava*.—*a*. The spadix, communicating with the cenosarc. *b*. The endoderm of the gonozooid. *c*. The ectoderm of the same. *d d*. The ectotheca, enclosing the gonozooid. *a'*. Ovum. The gonozooid, *a, b, c*, is the equivalent of the manubrium. IX. Gonophore of *Aglaophenia pluma*.

stage of their development they liberate themselves from the parent stock, escape from the sac which had hitherto confined them, and enter on a term of independent existence. (Woodcut, fig. x.)

Fig. x.



a. The gonozoid enclosed in its ectotheca. *b.* The same, after the rupture of the sac, on the point of detaching itself.

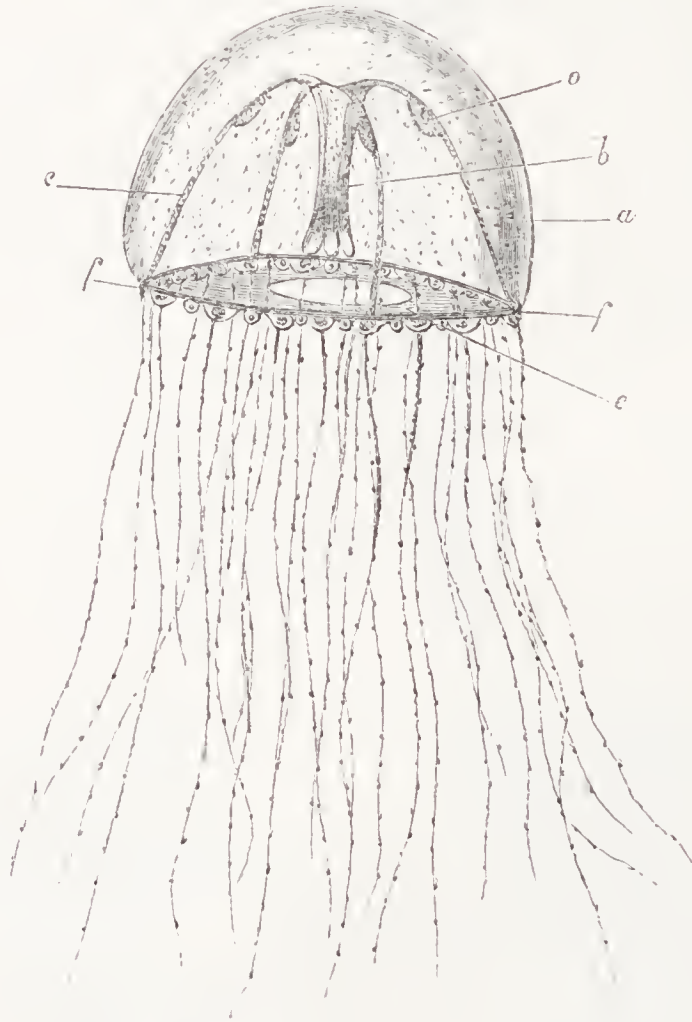
They are now altogether separated from the colony to which they belong, and so thoroughly are their affinities concealed by the locomotive and other adaptive organs with which they are furnished, that they might readily pass for members of another tribe. Indeed we can scarcely imagine a more complete contrast to the staid and stationary zoophyte, in outward form and habit of life, than the medusiform zooid which it evolves from its own sub-

stance and sends forth laden with the seed of new commonwealths.

The free sexual zooid, with two or three exceptions, assumes the form of a medusa, and is furnished with a contractile swimming-bell or umbrella, by whose rhythmical contractions it is propelled through the water. (Woodcut, fig. xi. *a*.)

From the centre of the crystal dome is suspended a hollow

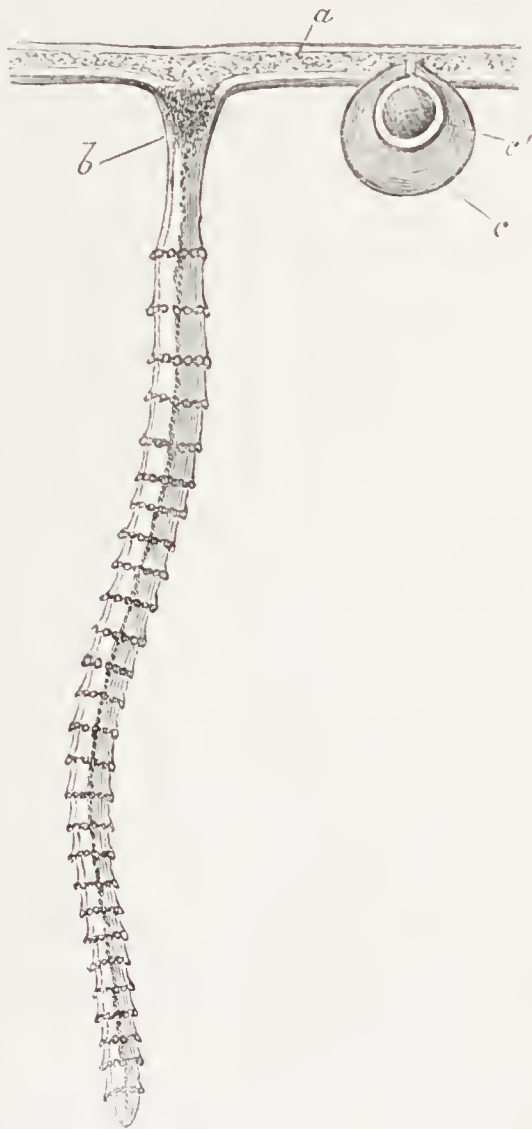
Fig. xi.



body (the *manubrium*, Woodcut, fig. xi. *b*), terminating at the free extremity in a mouth, and at the point of attachment in communication with a number of radiating tubes or canals (Woodcut, fig. xi. *c*), which pervade the substance of the umbrella, extending to its margin, where they join a circular canal that connects them all (Woodcut,

fig. xi. *f, f*). The swimming-bell (the float and natatory organ, and the most striking feature of the structure) is partially closed below by a filmy membrane or veil, in the centre of which there is a circular aperture (Woodcut, fig. xi. *e*). Its margin is furnished with a larger or smaller number of tentacles, and in many cases with a series of small sacs, in which one or more refractile spherules are enclosed. The latter are in all probability simple organs of sense; but of what nature, we are not in a position to determine (Woodcut, fig. xii.). Their function has been

Fig. xii.



a. The circular canal. *b*. The ocellus. *c*. The sac or lithocyst. *c'*. The spherule of lime.

supposed to be auditory; but the conjecture is hardly borne out by an extended investigation of their structure.

At the base of the tentacles (Woodcut, fig. xii. *b*) there is often a collection of pigment-cells (a coloured spot or ocellus) in which a crystalline body is sometimes imbedded, as in *Eleutheria* and *Clavatella*. In *Tiaropsis diademata*, Agassiz describes as many as fourteen highly refractive bodies, or lenses, as forming a crescent within the pigment-spot*. These ocelli are regarded, with much probability, as rudimentary organs of vision, or at least as holding a place in the Hydroid economy analogous to that of the eye in higher organisms. It is interesting to remark that these very simple organs of sense make their appearance only in the zooids which are destined to become free.

The digestive cavity is lodged in the manubrium, and the nutritive material prepared in it passes into the canals and circulates through them; the oral extremity is sometimes lobed, and sometimes furnished with tentacular appendages, which assist in the capture of food.

The generative elements are developed either between the two membranes that form the walls of the manubrium, or in special sacs, which are borne on the radiating canals (Woodcut, fig. xi. *o*). They usually occur in the former position amongst the *Athecata*, and in the latter amongst the *Thecaphora*; but the distinction is not universal. The period at which the ovaries and spermaries make their appearance varies considerably; in some cases they are developed before the zooid detaches itself, in others not until long after its liberation.

The free gonozooid has by no means attained its full

* Contributions to the N. H. of the U. S. vol. iv. p. 309.

development and perfect form on leaving the parent stock ; in a large proportion of cases it undergoes very considerable change subsequently. The form of the umbrella may alter, and the marginal tentacles and other bodies and even the radiating canals increase greatly in number ; while the manubrium may become much elongated, or develop additional oral appendages *. The early and mature states are often so dissimilar as to have been referred to different species ; and as there is seldom the opportunity of observing the whole course of development, the varying phases of the sexual zooid are a source of much perplexity to the systematist †.

Gemmation is not confined to the fixed portions of the Hydroid colony ; it also enters into the history of the free and locomotive zooids. In many cases they manifest the vegetative tendencies of their tribe, and multiply rapidly by budding. Gemmation seems usually to take place when the true reproductive function is in abeyance. Thus in the spring the gonozooid of *Clavatella* develops buds on the margin of the body between each pair of tentacles, which are cast off at a certain stage of growth ; while later on in the year the vegetative activity ceases, and reproduction by ova and spermatozoa takes its place. These buds, which are analogous to those produced in such profusion by the *Hydra*, bear an exact resemblance, when mature, to the zooid that originated them. In other cases they spring from the manubrium, or from the bul-

* A. Agassiz has pointed out that the tentacles are developed in a certain fixed order, and has given the formula of development for many species. (Proc. Boston Nat. Hist. Soc. vol. ix., August 1862.)

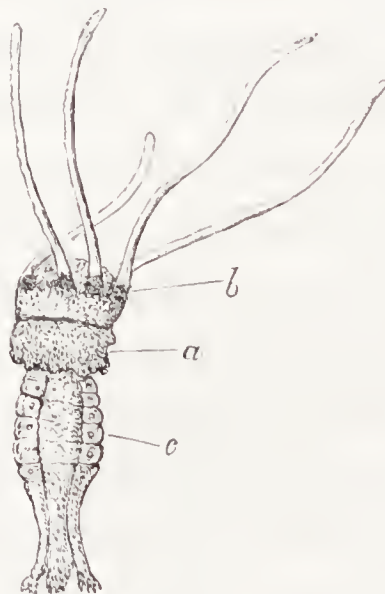
† A good illustration of the changes which the detached zooid may undergo before reaching maturity, and of the complexity of structure which it may finally attain, is afforded by the genera *Bougainvillia* and *Zygodactyla*.

bous base of the tentacles, or from the tentacle itself, or from the radiating canals.

The free zooid, then, after its detachment, may pass through many stages of growth and development itself, and originate a large number of similar organisms, before proceeding to discharge its principal function, the elaboration of the generative elements. With the escape and dispersion of the latter, its existence, in all probability, usually terminates.

Towards the end of its course it sometimes loses its locomotive organs and passes into a state of quiescence, and in this condition closely resembles, in all essential particulars, an ordinary polypite. The locomotive energy fails, the umbrella is first reversed and then shrinks into a shapeless mass, which hangs about the base of the body, and bears the tentacles streaming behind it. (Woodcut, fig. xiii.)

Fig. xiii.



The medusiform zooid of *Podocoryne carnea* in its quiescent stage.—*a*. The remains of the swimming-bell. *b*. The tentacular bulbs. *c*. The ova in the walls of the manubrium.

The adaptive dress which had fitted the zooid for a free

existence, and which disguised its real affinities, is cast aside, and that which remains is at once recognized as a polypite. During the period of quiescence the ova are liberated, and the manubrium then dissolves away*.

It would be difficult to exaggerate in speaking of the beauty of these floating flower-buds, as they may well be called. The vivid tints which they often display, the gracefulness of their form, the exquisite delicacy of their tissues, and the vivacity of their movements, combine to render them singularly attractive. Frequently they are so perfectly translucent that their bubble-like forms only become visible in a strong light. In other cases the umbrella is delicately tinted, while the manubrium displays the gayest colouring, and brilliant ocelli glitter on the bulbous bases of the tentacles. To their other charms that of phosphorescence is often added; they are not only painted like the flower, but at night they are jewelled with vivid points of light, set round the margin of the bell, or one central lamp illumines the little crystal globe, and marks out its course through the water. Though individually minute, their numbers are so immense that they play an important part in the production of the luminosity of the ocean. The surface of the sea for miles together is often thickly covered with them; and on still, sunny days

* This "retrograde metamorphosis" has been observed by Dujardin and Holdsworth in *Cladonema*—in *Podocoryne* by Lovén, Peach, and myself, in *Syncoryne* by Allman and myself, and in *Turris* by Gosse, who remarks, after describing the reversion and disappearance of the umbrella, "of the scores kept, this was the common, and therefore, I suppose, the natural termination." I have observed the same thing universally in *Podocoryne carnea*. The gonozooid of *Clavatella*, which has no swimming-bell to dispose of, equally loses its locomotive habit towards the close of its life, and fixing itself by the suctorial disks that had before served it as feet, remains perfectly inactive until the escape of the ova, which is speedily followed by its own dissolution.

in autumn certain species swarm in immense shoals off the coast*. Any one who has watched the escape of the gonozooids from a specimen of the common *Obelia geniculata* will feel no surprise at the accounts which are given of the numbers of minute medusæ that sport near the surface of the ocean, and at night make it glow with phosphoric fires.

In this species each of the pretty urn-like capsules, which are produced in great profusion, contains a large number of zooids; and several hundreds are soon liberated even from a small specimen. On the vast tangle-beds that fringe all portions of our coast, *Obelia geniculata* is universally present, forming extensive forests over the long ribbon-like fronds; and from these, during the breeding-season, countless thousands must be cast off.

The stationary life of the polypite does not offer much to interest the observer; but the habits of the medusiform zooids are singularly attractive.

Like miniature balloons they float suspended in the water for awhile; then they suddenly start into motion, propelling themselves by a series of vigorous jerks or casts, and at the same time contracting the tentacles into the smallest compass; then they become quiescent again, and sink slowly and gracefully, like parachutes, to the bottom of the vessel, some of the arms extended laterally, and the rest dependent. In all cases locomotion is effected by the pulsation (the alternate systole and diastole) of the swimming-bell.

The tentacles have various uses. They assist in the capture of prey; they are employed as organs of attach-

* A. Agassiz, 'Catalogue of North American Aculephæ,' p. 73.

ment, by means of which the zooid anchors itself while searching for food; they also serve occasionally as legs. They are well armed with thread-cells, the deadly power of which compensates for the feebleness of the frail organism in other respects, and enables it to deal with creatures much higher in the scale of being than itself.

It is interesting to watch the zooid when in quest of food. Anchoring itself by some of its tentacles, it casts out the remainder in all directions, elongating and attenuating them to an extraordinary degree, and keeping the extremities in a state of incessant tremulous motion, as if feeling for something.

The mouth, placed as it is at the extremity of a free and extensile body, and often furnished with tentacular appendages, is in itself well adapted for the capture of prey. In the later stages of its existence, when the swimming-bell has collapsed and the tentacles are no longer available, the gonozooid is dependent on this organ for its supplies of food.

At first sight there appears to be a total dissimilarity between the (so-called) medusa and the polypite. In general aspect and in mode of life they present a striking contrast. The structural affinities between them are completely veiled by the modifications which adapt the sexual zooid to a free and locomotive existence. The swimming-bell is a mask, behind which the polypite is effectually concealed. We cannot wonder that the escape of the (so-called) medusa from the reproductive capsule of the zoophyte was at first regarded as a marvel, and excited so lively an interest. But the medusiform structure (which, with one or two exceptions, is characteristic of the zooids that are destined for independent existence) is only a

variation on that which we find in the polypite, exhibiting the same principal elements, which are modified in conformity with the new conditions of being. The free gonozooid is essentially a polypite suspended in a contractile bell, which bears it through the water. We have only to imagine an ordinary alimentary zooid, detached and with its tentacles united by a web for a portion of their length, to have a structure closely resembling the (so-called) medusa. In *Campanulina acuminata* the arms of the polypite are, to some extent, palmate (Plate XXXVII. fig. *b*), and in the delicate web which connects them we have the homologue of the swimming-bell*. A polypite of this genus, separated from its colony, and floating by means of its tentacular disk, would suggest at once the aspect and habit of the medusiform zooid.

In its highest form the sexual polypite takes on a structure which fits it for independent existence. The tubular appendages, which in the nutritive zooid are mere prehensile organs†, are now connected for the greater portion of their length by a highly contractile membrane, and form a bell or disk, which serves as a float and a propeller. The extremities remain free, and discharge the office of ten-

* Prof. Allman has remarked that in all cases the tentacles of the polypite are necessarily included in the thickness of the body-walls for some distance from their origin. And this included portion he regards as the representative of the radiating canals. ("Report on the Reproductive System in the Hydroids," Rep. Brit. Assoc. for 1863, p. 364.)

† The view which regards the tentacles of the polypite and the radiating canals of the (so-called) medusa as homologous parts is confirmed by many considerations. It is worthy of remark that in some cases (e. g. *Zygodactyla*) the canals increase in number as the zooid advances towards maturity, just as the tentacles of the polypite do; and the course of development is the same in both. The new canals originate at the base of the manubrium, and gradually grow downwards to the circular vessel on the margin.

taeles. An outgrowth from the margin of the membranous bell forms the *veil*, which partially closes it below.

The body, containing the stomach, and corresponding with the proboscis or anterior portion of the ordinary polypite, is suspended, as it were, from the centre of the domed roof of the swimming-bell, and hangs free in its cavity. In the alimentary polypite the homologous structure stands erect in the centre of the tentacular wreath.

The tentacular tubes, which form in the free zooid the ribs on which the umbrella is, as it were, supported, also serve as the canals through which the nutritive fluid circulates*. They communicate, like the tentacles of the polypite, with the cavity of the stomach, and are further united at the margin of the swimming-bell by a circular canal. This additional structure completes the simple circulatory system. So far it is the only element which has not its homologue or equivalent in the polypite.

In *Clavatella* we have an intermediate form, which throws much light on the relation of the medusiform structure to that of the polypite, and very clearly links the two together. In this genus the sexual zooid, though free and locomotive, is not furnished with a swimming-bell. It wants the striking feature of the (so-called) medusan structure, and, instead of floating and swimming, moves by means of suctorial disks, borne at the extremity of a branch or fork of the arms. (Plate XII. fig. 2 *a*.) But though ambulatory in its habits and destitute of the contractile float, it reminds us at once of the medusa. It has the same general form : as it moves, the mouth hangs downwards ; and round the body, at the base of the tentacles,

* In the *Hydra*, the tentacles are simple tubes into which the fluids penetrate freely.

are a number of coloured ocelli. On examination it is found to be furnished with radiating canals, which are short and broad, and correspond in position with the arms. There is also a circular canal.

The tentacles exactly resemble those of the polypite, with the exception of the branches bearing the adhesive disks. In other respects there is the closest resemblance between the free zooids of *Clavatella* and its polypite. The oral extremity of the latter, detached from the long pedunculated body which supports it *, requires very slight modification to convert it into the curious ambulatory structure which is charged with the propagation of the species. Putting aside for the moment the eye-specks and the locomotive appendages which are superadded to the stationary organism, there is but a single point of difference between the two of any significance. In the gonozooid a larger portion of the tentacles is included in the body-walls than in the polypite, and the included portions are united by a circular vessel †. The sexual zooid of *Clavatella* may be regarded as a partially developed medusa ; it is as clearly a slightly modified polypite. If we imagine the extension of the body-wall upon the tentacles to be carried somewhat further, we have the perfect swimming-bell.

The close resemblance between the gonozooid and the

* This seems to have its homologue in the pedicle by which the gonozooid is attached to the parent stock, a portion of which it bears with it for a time after liberation.

It may be noted further that the reproductive buds of *Clavatella* are destitute of any ectothecal covering, and exactly resemble the polypites in their mode of growth.

† The study of *Clavatella* leaves no room for doubt as to the homological relation between the radiating canal and the tentacle.

polypite in this zoophyte is somewhat concealed by the peculiar habit of the former, as it is seen striding along with inverted mouth. But in the kindred genus *Eleutheria* the special locomotive organ is wanting, the mouth of the gonozoid is turned upward as it moves, and it has all the appearance of a polypite propelling itself, with little apparent ease or agility, by means of its tentacles.

So much may suffice respecting the structural identity between the two principal elements of the Hydroid colony—the polypite and the (so-called) medusa, which, on a superficial view, appear to offer such a complete and striking contrast*.

In the free sexual zooid with its contractile bell and mercurial habit, which not only matures but also diffuses the seed of new generations, the hydroid structure reaches, as it were, its culminating point.

In a large proportion of cases, however, the reproductive element appears in much humbler guise. The gonozoid is permanently attached to the colony, like the alimentary polypite, and develops and liberates its products *in situ*. Amongst these fixed zooids, which are extremely numerous, a gradation of structure is traceable. A series of transitional forms connects the simplest of them, which is a mere sac, with the most complex, which makes a near approach to the medusa in structure, though not destined to become free. In different species the development of the gonozoid is, as it were, arrested at different points; and it is only in certain cases that it attains the highest

* I have not attempted to give an exhaustive view of this deeply interesting portion of my subject. Those who desire a fuller treatment of it may consult the works of Prof. Allman, and especially his admirable paper on *Cordylophora* (Phil. Trans. June 1853), and his "Report on the reproductive system in the Hydroida." Report Brit. Assoc. for 1863, pp. 363-366.

condition—that of an organism endowed with the means of locomotion, and fitted for independent being. Thus in *Hydra* it is a mere bulging of the body-wall, between the two layers of which the generative elements originate; and this, it must be remembered, is the earliest stage of all the more complex forms. In *Clava* it is a distinct process,

Fig. xiv.



Male capsule of *Gonothyræa Lovéni*.—*a*. A gonozooid, still within the capsule. *b*. The spermatogenic mass. *c*. The spadix communicating with the cavity of the ecnosarc. *a'*. A gonozooid, borne at the summit of the capsule, discharging the spermatozoa. *b'*. The spermatogenic mass, fully developed. *c'*. The spadix.

containing a prolongation of the general cavity of the body,

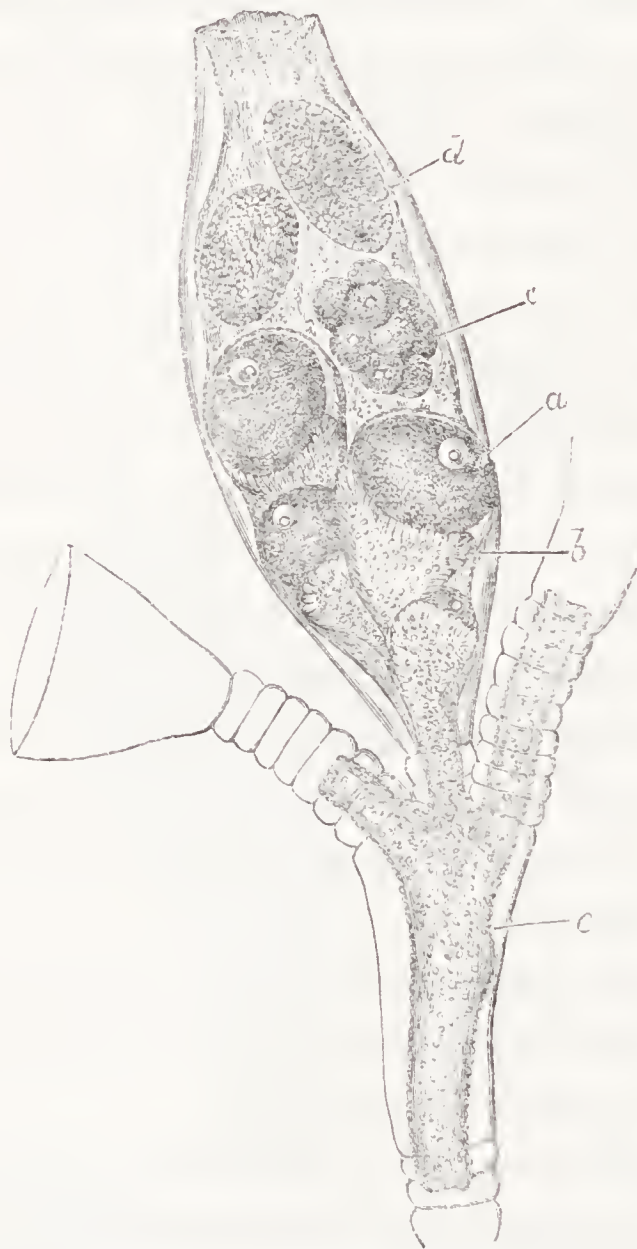
enclosed by the two membranes (ectoderm and endoderm) ; it is, in fact, a *manubrium* without the oral aperture, nutrition being provided for by the general circulation. In other cases a membranous envelope (which is the equivalent of the swimming-bell) and rudimentary radiating canals are super-added. In *Tubularia* a still further advance is made ; the gonozoid, though permanently attached, is furnished with a swimming-bell, in which the canals are present and the orifice, round which are set four tubercles representing the marginal tentacles. (Plate XX. fig. *b*.) The manubrium is destitute of a mouth. In this form there is every preparation for free existence up to a certain point ; but the gonozoid remains enveloped in the ectotheca, and the swimming-bell is converted into a nursery, in which the embryo passes through the later stages of its development. In *Gonothyræa* (Woodcut, fig. xiv.) a yet nearer approach is made to the medusiform structure : the umbrella is furnished with tentacular appendages ; and the gonozoid at a certain stage is pushed beyond the orifice of the capsule, and hangs there as if on the very point of escaping and entering upon a separate existence. It maintains its connexion however, and, like the seed-vessel, after ripening and scattering its products it withers away.

Many other modifications occur ; but those which have been mentioned exhibit the gradual transition from the simplest to the most complex form.

Occasionally we see the development of the gonozoid arrested at a certain stage, and, instead of becoming free as in normal cases, it continues in connexion with the parent stock. Thus in *Syncoryne* the sexual zoid is usually locomotive ; but towards the close of the breeding-season, it is sometimes met with in a depauperated condition, without

tentacles and with a merely rudimentary mouth: though the swimming-bell exhibits contractility, it never acts as a locomotive organ, but the zooid continues attached and does not attain a much higher point of development than that of *Tubularia*. I have observed a similar seasonal arrest of development in *Podocoryne proboscidea*. In such

Fig. xv.

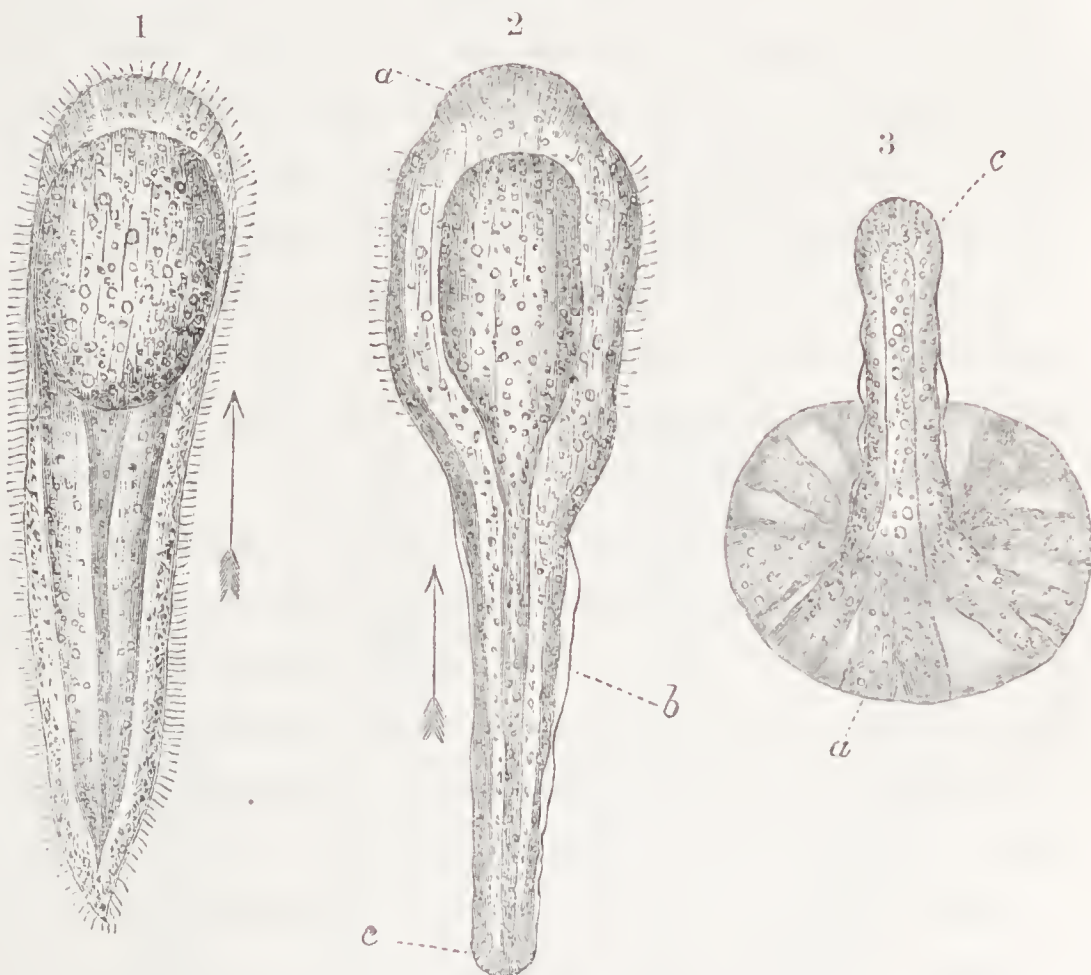


Female capsule of *Campanularia flexuosa*.—*a*. An ovum, with germinal vesicle and spot, still confined between the walls of the gonophore. *b*. The spadix, communicating with the general cavity of the cœnosarc. *c*. An ovum in one of the stages of segmentation. *d*. A planula. *e*. The cœnosarc of the zoophyte.

cases we have the fixed and the free condition of the gonozoid within the limits of a species, the former being abnormal and the result of partial development, but representing a perfect and permanent form in another portion of the series.

It only remains to give a short account of the development of the Hydroid embryo. (Woodcut, fig. xvi.) The

Fig. xvi.



1. The planula of a Campanularian Hydroid.

2. The same, in a more advanced stage.—*a*. The enlarged extremity, by which the embryo attaches itself. *b*. The chitinous film. *c*. The point at which the polypite is developed.

3. The young Campanularian soon after attachment.—*a*. One of the tubular lobes into which the disk divides.

The arrows show the direction in which the planule moves.

ovum after impregnation passes through the various stages of segmentation, and is resolved at last into a minutely

granular mass; and this, by the rearrangement of its material, and further development, is transformed into the elongate and somewhat conical embryo known as the *planula*. (Woodcut, fig. xvi. 1.) When mature, the embryo escapes from the reproductive sac into the water, and for a short period enjoys a free and active existence. The centre of the body is now found to be occupied by an elongate cavity; the walls which enclose it are composed of two layers, the ectoderm and endoderm; and the surface is all but universally clothed with vibratile cilia*. After a while the body enlarges towards one extremity, and a thin chitinous film forms over a portion of its surface (woodcut, fig. xvi. 2); the movements become sluggish; and at length the cilia disappear altogether, and the embryo fixes itself by the enlarged end, which expands into a flat, circular disk, the remainder of the body standing erect in the centre of it. (Woodcut, fig. xvi. 3.) The disk, by which the embryo is now permanently attached, soon breaks up into a number of lobes, which again divide dichotomously. (Woodcut, fig. xvi. 3 a.) The whole structure is at this stage invested by a chitinous envelope or polypary.

As development proceeds the upper extremity is moulded into a polypite within a transparent urn, the lid of which it pushes off when mature. From this primary stem, with its single polypite, by a series of successive buddings the complex plant-like structure is evolved; while the discoid base gives off the delicate threads that net the surface of weed or stone, and originate and hold together in organic union whole forests of tree-like shoots.

* The planule of *Coppinia arcta*, in many respects an anomalous species, is not ciliated. The embryos of *Coryne vaginata* are unciliated amœboid bodies, which undergo remarkable changes of form after liberation.

The course of development is subject to one or two variations. In some cases the entire body of the embryo on becoming attached spreads out into a circular disk, from the centre of which the stem is subsequently developed. In *Tubularia* (Plate XX. figs. *c*, *d*) and in *Coryne Van-Benedenii* (p. 46) the planule stage is wanting, and the embryo takes on the form of the polypite before leaving the gonophore. When it escapes from its confinement the body is furnished with an oral aperture at one end, surrounded by a number of tentacles; it continues locomotive for a short time, and then fixes itself by the aboral extremity, and develops a stem and the full complement of arms.

In some of the species which are furnished with a

Fig. xvii.



The gonotheca of *Sertularia cupressina*.—*a*, *b*, *c*. The capsule crowned by the marsupium in various stages of development. *d*. The capsule with the marsupium ruptured for the escape of the planulae.

chitinous receptacle for the protection of the gonophores (*Thecaphora*), the ova at a certain stage are transferred to a kind of nest or marsupial sac enveloped in a thick

gelatinous covering*, and borne at the summit of the capsule, in which they complete their development. (Woodcut, fig. xvii.) This species of nidification is far from uncommon. The marsupium is sometimes formed, as Allman has suggested, by an extension of the endotheca or membrane which immediately confines the ova (Woodcut, fig. xvii.) ; but in other cases the entire gonozoid is pushed upward, and at last beyond the opening of the capsule, by the growth of the column supporting it, and, having secreted a gelatinous coating, is converted into a kind of nest, in which the ova pass through the later stages of their development†.

It may be well briefly to sum up the leading facts of the reproductive history of the Hydroida.

In each colony, the alimentary and reproductive functions are distributed amongst two classes of zooids.

The sexual zooids, like the flower-bud of the plant, are only developed at certain seasons, and occupy various positions in the different species. In a large number of cases they exhibit a modification of structure adapting them for independent existence, and when mature detach themselves from the colony and become free and locomotive.

The free sexual zooid, in all but one or two exceptional cases, may be regarded as essentially a polypite with its arms united by a contractile web, so as to form a float and natatory organ. Disguised by its adaptive dress, it has been separated from its kindred under the name of a medusa ; it is in reality a swimming polypite.

* The *acrocyst* of Allman.

† Wright has observed this in *Opercularella lacerata*. The marsupium of *Campanularia neglecta* is formed in the same way. (*Vide* p. 172.)

When liberated, it matures and disperses the generative elements, and, having thus fulfilled its function, perishes.

In other cases the gonozooids never become free, but, like the alimentary polypites, remain in permanent connexion with the colony. In this condition they exhibit many diversities, and constitute a series of transition forms leading up to the highest, in which the provision for a free and locomotive existence is complete.

The embryo of the Hydroida is all but universally a ciliated body, the analogue of the winged seed of the plant, which diffuses the species.

RATE OF GROWTH. PHOSPHORESCENCE.

All the evidence we possess on the point seems to show that the development of the fixed Hydroida proceeds rapidly. Timber immersed in the sea is soon found to be covered with a luxuriant growth of zoophyte. Mr. Couch considers it probable that a large specimen of *Sertularella polyzonias* may be formed, under favourable circumstances, in fourteen days. At Rio Janeiro a *Eudendrium*, allied to *E. rameum*, has been observed to cover the bottom of a boat in fifteen days. Stimpson mentions that, on the hooker which he used for dredging at Grand Manan, an *Obelia* had reached the height of an inch in less than a month after the bottom of the vessel had been scraped clean; and Van Beneden speaks of the great rapidity with which *Tubularia coronata* is developed along the coast of Belgium*.

* The following illustration of the enormous rate at which some of the Hydroids multiply is from M'Crady:—"I have observed the medusæ (of *Tubularia cristata*) fully grown and casting their larvæ as early as March 10th, and as late as September 13th, during all which time thousands of larvæ are

As amongst plants, some species are annuals, especially such as are parasitic on the fronds and stems of seaweed, while others are probably perennial. The large, arborescent masses of the stouter kinds of *Sertularia*, *Halecium*, *Eudendrium*, &c. must be the growth of several seasons. Van Beneden has seen specimens of *Tubularia* and *Campanularia* live for several years in an aquarium without any diminution of their vegetative activity. The medusi-form zooids, the vagrant members of the colony, are comparatively shortlived; their function is seasonal, and as soon as it is fulfilled they perish*.

It seems to be not improbable that the polypites in some cases perish in the winter, like the leaves of deciduous plants, and are renewed with the return of spring. Lamouroux states that he had found this to be the case in some species; and Lieut. Thomas, in a note on *Eudendrium ramosum*, records the fact that at Alloa, where this zoophyte is abundant, no specimens were found "with 'heads' on in the month of November" †. Dr. Strethill Wright, too, as mentioned before, has seen many specimens of *Hydractinia* in which the cœnosarc was fully developed in winter, but the polypites were few in number

continually shed, and in consequence thousands of new colonies established, their multiplication becoming so great during a favourable season that the rocks literally appear clothed with the yellow stems and rose-coloured blossom-like bodies of these flower-animals."—*Gymnophthalmata of Charleston Harbour*, Proc. Elliott Soc. Charleston, vol. i.

* "Dans les plantes comme dans les animaux, la vie est généralement longue et la ténacité grande dans les individus agames; éphémère et délicate, au contraire, dans les individus sexués. L'analogie entre la méduse et la fleur se confirme de plus en plus."—*Van Ben. Polypes*, p. 101.

† Supplement to Johnston's 'British Zoophytes.' p. 467.

or altogether wanting. On the return of spring, however, they reappeared.

The polypites of the Hydroid colony, as well as their medusiform brethren, exhibit in many cases the beautiful phenomenon of phosphorescence. This has been observed in many species, but only, I believe, amongst the Thecaphora. Mr. Hassall has celebrated the beauty of the trawl-nets when raised at night, draped with zoophytes which glitter "like myriads of the brightest diamonds." The luminosity resides in the living polypites, which, when irritated, instantaneously light up their little coloured lamps, and literally flash fire at their assailants. The common *Obelia geniculata*, which may be met with on every coast, is a phosphorescent species, and, if agitated soon after its removal from the sea, will furnish a fine display of "living stars."

GEOGRAPHICAL DISTRIBUTION.

Little can be said on this branch of the subject. So far as we can judge, the British Hydroida, with a few exceptions, are generally distributed round our coasts. There seems to be little localization of species. As yet we have only an imperfect knowledge of the distribution of the smaller kinds; but the large and well-known species have most of them a very wide range. A few forms are essentially boreal and do not descend below the north-eastern section of the English coast: such are *Salacia abietina* and *Sertularella tricuspidata*. *Sertularia fusca* has only been observed on the east coast of Scotland and the north-east coast of England.

The eastern sea-board is fully exposed to the sweep of polar currents, which exert a very marked influence on its

fauna. This is recognized in the absence of many fine species of Hydroida which occur on the southern and western coasts, as well as in the presence of a few northern forms that are not found elsewhere, and the prevalence of others which become rare in warmer districts. *Thuiaria thuja*, which is abundant in the extreme north (North Cape &c.), is one of the characteristic hydroids of the east coast of England. It all but disappears in the west, being extremely rare along the coasts of Devon and Cornwall. The *Aglaopheniæ*, on the other hand, which flourish so remarkably in the south-west and along the north-western coasts that are exposed to Gulf-stream influences, barely put in an appearance in the north-east.

Of *A. pluma* Mr. Alder mentions only a single specimen as having occurred in Northumberland and Durham. *A. myriophyllum* is reported equally rare, while *A. pennatula* and *A. tubulifera* are absent altogether.

Three species, *Diphasia alata*, *Calycella fastigiata*, and *Aglaophenia tubulifera*, have been found in Cornwall and also in Shetland, the Hebrides, and on the *west* coast of Scotland, but nowhere else in Britain. The last-named flourishes luxuriantly in Oban Bay, having for its companion there, as in Cornwall, the beautiful coral, *Caryophylla Smithii*; and it has lately been obtained by Mr. Norman in the Hebrides. There can be little doubt that the peculiar distribution of these species, no less than that of the Madreporæ, is due to the influence of the warm current, which after bathing the south-western shores of England, sweeps away to the north, touching the Orkneys and Shetland in its course. *Aglaophenia tubulifera* is also a South-African form.

To the same genial influence we owe the remarkable

beauty and luxuriance that distinguish the zoophytes of Devon and Cornwall and, to a less extent, of the west coast of Scotland.

A few species are decidedly local. *Diphasia pinnata*, the finest of the British Sertulariidae, is confined to the coast of Devon and Cornwall. *Coryne vaginata* is the common representative of its family in the south and west, but does not range northward, so far as we know at present.

Syncoryne eximia fills a similar position on the east coast, and does not appear to occur elsewhere.

A large number of the Athecata have only been observed hitherto in the north; but as most of them are minute species, and have only been discovered recently, we should not be justified in drawing any inferences as to the extent of their range.

If we turn now to the foreign relations of the British Hydroids, we find that a large number of them occur along the Atlantic coasts of North America, mingled with others. At least thirty species are known to be common to the two faunas*. The North-Pacific forms seem to be altogether distinct from our own. A few of our British species cluster about the North Cape: most of these have a very wide range of distribution; but one or two are chiefly confined to the north-eastern division of our coast.

Many Hydroids are common to Britain and the Mediterranean. *Clavatella*, which has been found as far north as Whitby, on the east coast of England, ranges to Nice; and *Podocoryne carnea* is at home in Norway and at Naples. Some of our species are inhabitants of the coast of Labrador, the polar waters that bathe the North Cape,

* The Hydroid fauna of Labrador and the Gulf of St. Lawrence seems to be to a large extent identical with that of our own north-eastern coasts.

and the Mediterranean. A small group of forms, including a few of the *Plumulariidae* and some of the most cosmopolitan of the *Sertulariidae*, is common to Britain and South Africa.

In the South Pacific the Hydroid genera are represented, for the most part, by species distinct from our own; but a few British forms have been noticed at various points in Australia and the neighbouring seas*.

METHOD OF COLLECTING THE HYDROIDA.

The British Hydroida are all marine, with the exception of *Hydra* (a truly fluviatile form) and *Cordylophora* (which is an inhabitant of fresh water here, but elsewhere is met with in waters more or less saline). Some of the species are confined to deep water; but a very large proportion are littoral, or inhabit the Laminarian zone, which skirts the shore. On a favourable coast, where a large extent of rock is laid bare at low tide, a rich harvest may be gathered without resorting to the use of the dredge. A large number of the more minute Athecata (*Hydractinia*, *Corynidae*, *Atractylidae*, *Tubulariidae*, &c.), including many of the rarer and more interesting forms, are littoral in their habits, and also many of the *Campanulariidae* (the exquisite "Bell Corallines"), of the smaller *Plumulariidae*, and other Thecaphora. Many species manifest a preference for certain zones of the space included between tide-marks, and are only found within very definite limits. Some are confined to certain kinds of weed, or almost invariably

* *Diphasia pinnata* at Sydney (and also in South Africa), *Plumularia obliqua* in Van Diemen's Land, *Sertularia attenuata* at Port Adelaide, and *Lafoëa fruticosa* in Bass's Straits.

Sertularella polyzonias and *Sertularia operculata* seem to be the two British species which have the widest range.

associate themselves with certain kinds of mollusk. The peculiarities of habitat are very curious, and must be learnt by observation and experience.

The littoral Hydroids must be sought in the tide-pools, both large and small, in the chinks and crannies of the rock, on the underside of stones, and beneath the hanging weed. I have described elsewhere (*vide* p. 298, note) the method of search which is most likely to prove successful in the case of the minuter species, and the apparatus which is requisite. Of course a vast deal may be done in a more "casiful" way; but the collector will find an ample reward for his labour, whatever it may be, in the beauty of the scenery which it will open to him, and the interest of the material which he will gather.

The larger Sertularian zoophytes, whose graceful plant-like forms are so familiar, can only be obtained in the living state by means of the dredge; but the horny skeletons may be gathered on most sandy beaches, and frequently in great profusion, after stormy winds. Large tangled masses of them, which are full of beauty in themselves, are cast ashore, and if examined while still fresh and moist will often be found to conceal some of the smaller kinds in a living state. The dredge, indeed, is essential to those who would thoroughly investigate the Hydroida; but rich material for study and a great variety of forms may be obtained on the shore.

The free medusiform zooids may be captured with a hand-net from the rocks, or by means of a tow-net from a boat, especially in still, warm autumn weather, when they swarm near the surface of the sea. They are difficult to keep; and few have as yet succeeded in obtaining and hatching the ova, and tracing the development into the polypite

form. Those who have the opportunity will do well to take up this line of investigation, which promises to yield the most interesting results. The reproduction and development of the Hydroida may be studied with great facility in many of the littoral species of *Coryne*, *Syncoryne*, *Perigonimus* and *Tubularia*. The ubiquitous *Obelia geniculata* may always be readily obtained in summer with its capsules, within which the gonozooids may be watched through all the stages of their development, and from which they may be seen escaping in numbers.

The larger and stouter species of Hydroida may be preserved by drying; but even these lose much of their beauty in the process. The *Campanulariidae* should be kept in fluid*, as their calyces shrivel up when dried. The *Athecata* generally must also be preserved in the same way, as the polypites, which exhibit many varieties, afford important characters; and the mere polypary without them is, in a large proportion of cases, useless for the purpose of identification. Specimens kept in fluid retain much of their original beauty, though of course the exquisite colours that adorn many species are lost.

But to appreciate fully the extreme loveliness of these "animal-plants" they must be seen in life. A tuft of *Halecium* or *Eudendrium*, the one laden with white, the other with brilliantly tinted polypites, like blossoms on some tropical tree, is a perfect marvel of beauty. The unfolding of a mass of *Plumularia* taken from amongst the miscellaneous contents of the dredge and thrown into a bottle of clear sea-water, is a sight which, once seen, no dredger will forget. A tree of *Campanularia* or *Obelia*,

* The best methylated spirit is a good and convenient preservative fluid.

when each one of its thousand transparent calyces, itself a study of form, is crowned by a circlet of beaded arms, drooping over its margin, like the petals of a flower, offers a rare combination of the elements of beauty.

The rocky wall of some deep tidal pool, thickly studded with the long and slender stems of *Tubularia*, surmounted by the bright rose-coloured heads, is like the gay parterre of a garden. Equally beautiful is the dense growth of *Campanularia*, covering (as I have seen it in Plymouth Sound) large tracts of the rock, its delicate shoots swaying to and fro with each movement of the water, like trees in a storm—or the colony of *Obelia* on the waving frond of the tangle, looking almost ethereal in its grace, transparency, and delicacy, as seen against the coarse dark surface that supports it.

But, besides the remarkable beauty, there is a charm in the life-story of these beings. “There must always be a certain fascination in a history which tells us of animals composed of multitudes of individuals (zooids) living an associated life, and so combining as to produce the most graceful plant-like structures—vegetating like a tree—putting forth thousands of polypites, like leaves, each a provider for the commonwealth—putting forth also a company of buds, charged with the perpetuation of the species, ripening in transparent urns and scattering their winged seeds broadcast, or sent forth, moulded and painted by the highest art, like fairy emigrant-ships freighted with young life, to colonize distant seas. And these are the simple facts of nature”*.

* *Vide* an article by the author, entitled “Zoophytes: the History of their Development,” in the Quarterly Journal of Science, vol. ii. no. 7, p. 416.

BIBLIOGRAPHY.

It is unnecessary to give any extended list of works on the Hydroida, as those who are studying the literature of the subject will find full information in the 'Bibliographia' by Agassiz, published by the Ray Society, the supplementary volumes by Carus and Engelmann (*Bibliotheca Zoologica*, 1848 to 1860), and the invaluable 'Record of Zoological Literature,' issued annually under the editorship of Dr. Günther. A good list of Memoirs published subsequently to 1860 is prefixed to the 'Catalogue of North American Aculeata,' by Alexander Agassiz; while the well-known journal, the 'Archiv für Naturgeschichte,' contains a critical review of the Cœlenterate literature of each year by Prof. Leuckart, which is of the highest value to the student. In Prof. Greene's 'Manual of the Cœlenterata' there is also a list of some of the principal works and papers on the Hydroida.

A selected list, which may answer the general purposes of the student, is given at the close of the present work.

DICHOTOMOUS TABLES.

The following Tables are added to enable the student at once to refer any species which he may find to its place. It must be clearly understood that they do not represent natural affinities and relationships, but are a purely artificial contrivance to save time and somewhat wearisome labour. Having determined by their aid the genus to which his zoophyte belongs, the student should refer to the Synopsis of Families and Genera at the close of the Introduction to learn its position in the natural system.

The characters on which the dichotomous division is

based are, as far as possible, such as may be easily recognized. But the generic groups are frequently founded on differences in the reproductive system only; and in such cases it has been necessary to employ the gonozooid as the criterion. For example, *Coryne* and *Syncoryne* are identical so far as the trophosome is concerned, and are distinguished solely by the character of the sexual zooids; in such a case, if the reproductive bodies have not been observed, the only plan is to go through the species of the two genera until we find the description that answers to the form before us.

An illustration will best indicate the method of employing the Tables. Let *Tubularia indivisa* be the zoophyte that we wish to determine. It has a polypary, but no calyces, and therefore belongs to the *Athecate* division (Table I.); its polypites are *associated*, not solitary, and therefore under Bracket 1 we are referred to No. 3 for further information. Turning to Bracket 3 we learn that, as it has *tentacles of one kind only*, we must pass on to No. 7. Bracket 7 gives us the choice between capitate and filiform tentacles; and, as our zoophyte has undoubtedly the latter, we are referred to No. 11. There we at once place it under the first division, "*tentacles in two separate circles*," and are directed to No. 12, where we learn that it is an *Ectopleura* if it has free gonozooids, and a *Tubularia* if it has not. Should this point be undetermined, we may turn first to the genus *Ectopleura*, and finding that it contains but a single species, which is minute and not clustered, we shall at once be guided to *Tubularia* as our goal.

TABLE I.—ATHECATA.

Hydroida with a polypary, but without true calyces.

		Genera.
1.	<div> <div>Polypites solitary</div> <div>Polypites associated</div> </div>	<div>2</div> <div>3</div>
2.	<div> <div>Tentacles capitate and scattered over the body</div> <div>Tentacles filiform, in two circles ..</div> </div>	<div>MYRIOTHELA.</div> <div>CORYMORPHA.</div>
3.	<div> <div>Tentacles of two kinds</div> <div>Tentacles of one kind</div> </div>	<div>4</div> <div>7</div>
4.	<div> <div>Upper tentacles capitate; lower without capitula, rigid</div> <div>Upper tentacles capitate; lower filiform and flexile</div> </div>	<div>5</div> <div>6</div>
5.	<div> <div>Capitate tentacles in a single cru- ciform verticil</div> <div>Capitate tentacles in several cruci- form verticils</div> </div>	<div>CLADONEMA.</div> <div>STAUROIDIUM.</div>
6.	<div> <div>Stem simple</div> <div>Stem branched</div> </div>	<div>VORTICLAVA.</div> <div>ACHARADRIA.</div>
7.	<div> <div>Tentacles capitate</div> <div>Tentacles filiform</div> </div>	<div>8</div> <div>11</div>
8.	<div> <div>Tentacles scattered or in several whorls</div> <div>Tentacles in a single whorl</div> </div>	<div>9</div> <div>CLAVATELLA.</div>
9.	<div> <div>With free medusiform gonozooids</div> <div>Without free gonozooids</div> </div>	<div>10</div> <div>CORYNE.</div>
10.	<div> <div>Polypary composed of two coats ..</div> <div>Polypary simple</div> </div>	<div>ZANCLEA.</div> <div>SYNCORYNE.</div>
11.	<div> <div>Tentacles in two separate circles ..</div> <div>Tentacles scattered or in one circle</div> </div>	<div>12</div> <div>13</div>
12.	<div> <div>With free medusiform gonozooids .</div> <div>Without free gonozooids</div> </div>	<div>ECTOPLEURA.</div> <div>TUBULARIA.</div>
13.	<div> <div>Tentacles scattered</div> <div>Tentacles in a single verticil</div> </div>	<div>14</div> <div>17</div>

Genera.

14.	{ Polypites on a distinct stem	15	
	{ Polypites sessile	16	
15.	{ Stems a simple tube (or rarely with a single branch)		TUBICLAVA.
	{ Stems much branched and plant- like		CORDYLOPHORA.
16.	{ Tentacles few; the four uppermost long and erect		TURRIS.
	{ Tentacles very numerous		CLAVA.
17.	{ Polypites with a bilabiate mouth (and two tentacles)		LAR.
	{ Polypites with a simple mouth	18	
18.	{ Tentacles with bosses formed of large thread-cells placed a little above the base		HYDRANTHEA.
	{ Tentacles without bosses	19	
19.	{ Polypites sessile	20	
	{ Polypites on a distinct stem	22	
20.	{ Gonophores borne on polypites with- out tentacles	21	
	{ Gonophores borne on polypites with tentacles or on the adherent base		PODOCORYNE and CORYNOPSIS*.
21.	{ Polypites supported on a chitinous and muricated crust		HYDRACTINIA.
	{ Polypites developed on a simple retiform stolon		CIONISTES.
22.	{ Polypites with a trumpet-shaped proboscis		EUDENDRIUM.
	{ Polypites with a conical proboscis	23	
23.	{ Body of polypite and lower part of tentacles covered by a membra- nous sheath		BIMERIA.
	{ Polypites without such covering	24	
24.	{ Gonophores borne on polypites without tentacles		DICORYNE and HE- TEROCORDYLE.
	{ Gonophores borne on the cœnosarc	25	
25.	{ More or less arborescent		GARVEIA and BOU- GAINVILLIA.
	{ Small, and of simple habit		ATRACYLIS and PE- RIGONIMUS.

* These genera differ only in the character of the medusiform zooid.

TABLE II.—THECAPHORA.

Hydroïda with true calyces.

		Genera.
1.	<div> <div>{</div> <div> Calyces erect and free 2 Calyces adnate, disposed along the stem and branches 11 </div> </div>	
2.	<div> <div>{</div> <div> * Calyces supported on a short pro- cess from the stem; polypites only partially retractile 3 Without the stem-process; poly- pites wholly retractile 4 </div> </div>	
3.	<div> <div>{</div> <div> With snake-like tentacular organs distributed over the ecenosarc .. Without such organs </div> </div>	OPHIODES. HALECIUM.
4.	<div> <div>{</div> <div> Calyces truly campanulate or bell- shaped 5 Calyces not campanulate 6 </div> </div>	
5.	<div> <div>{</div> <div> Calyces operculated Calyces not operculated </div> </div>	LOVÉNELLA. CLYTIA, OBELIA, CAMPANULARIA, THAUMANTIAS and GONOTHYRÆA†.
6.	<div> <div>{</div> <div> Calyces ovato-conic ‡ Calyces tubular or cylindrical. . . . 7 </div> </div>	CAMPANULINA, ZY- GODACTYLA, OPERCULARELLA, and LEPTOSCY- PHUS.
7.	<div> <div>{</div> <div> Calyces with a conical operculum. 8 Calyces without a conical oper- culum 9 </div> </div>	
8.	<div> <div>{</div> <div> Calyces constricted at the base and pedicellate Calyces not constricted at the base and perfectly sessile </div> </div>	CALYCELLA. CUSPIDELLA.

* The process immediately supporting the calyele or the jointed shoot on which it rests is a projection from the stem. The calyces in this section only shelter the base of the polypites.

† In this group the trophosome affords no generic characters. If the reproductive bodies are absent, the student must treat it as a single genus, and identify his zoophyte by a reference to the specific descriptions.

‡ The calyces in this section are more or less *ovate*, becoming pointed above, where the margin is cleft into convergent segments. This form must be distinguished from the long, tubular shape.

		Genera.
9.	{ Calyces united towards the base by a cellular mass 10 { Calyces scattered 10	COPPINIA.
10.	{ Calyces rudimentary (exceedingly short cylinders) { Calyces not rudimentary.....	TRICHYDRA. LAFOEA.
11.	{ Without nematophores..... 12 { With nematophores 18	
12.	{ Calyces cylindrical, and disposed in longitudinal rows on all sides of the stem { Calyces otherwise disposed..... 13	SALACIA.
13.	{ Calyces decumbent, scattered along a creeping fibre (no erect stem).. { Calyces arranged in series along the stem and branches 14	FILELLUM.
14.	{ Calyces unilateral { Calyces biserial..... 15	HYDRALLMANIA.
15.	{ Calyces immersed { Calyces not immersed 16	THUIARIA.
16.	{ Calyces decidedly alternate, with a prominent operculum..... { Calyces without external oper- culum 17	SERTULARELLA.
17.	{ Gonothecæ (female) with a cleft margin and <i>internal marsupium</i> . { Gonothecæ with a plain orifice and without marsupium	DIPHASIA. SERTULARIA.
18.	{ With verticillate branchlets..... { Without verticillate branchlets .. 19	ANTENNULARIA.
19.	{ With a mesial nematophore at- tached to the front of the calycle { Without a mesial nematophore at- tached to the front of the calycle	AGLAOPHENIA. PLUMULARIA.

CLASSIFICATION.

It would be a fruitless labour to give any detailed account of the earlier systems of classification, which have now only an antiquarian interest. Those who are curious

in such matters may consult Johnston's 'History,' where they will find a careful review of all that had been done in this department from the time of Ellis downwards—and the third volume of Agassiz's 'Contributions to the Natural History of the United States.'

Until a very recent period the real facts of the Hydroid life-history had not been fully ascertained, and the basis of a natural arrangement was therefore wanting. Even when Johnston wrote the true nature of the medusiform zooid had not been determined, and he followed Van Beneden in regarding it as the embryo. At that time, also, a very small number of the (so-called) medusoids had been traced to their Hydroid stock, and the naked-eyed Medusæ were still treated as a group distinct from the Hydroida. The accumulation of facts has proceeded steadily since that period; but the correct interpretation of them and the elaboration of a really philosophical classification are amongst the latest results of research.

The Hydroid community presents two dissimilar elements, discharging respectively the functions of alimentation and reproduction; and in a large number of cases these two elements separate from one another at a certain stage, and lead thenceforth an independent existence. Before the connexion between these sundered parts was recognized, and while they were only known as distinct and dissimilar organisms, they were ranged under different classes and distinguished by different names. A double nomenclature was invented to designate what were only fragments of one and the same individuality. Integral portions of the same being were treated as if there were no affinity between them; and the zooid which had but lately detached itself from the Hydroid stock, and would

soon lay the foundations of a new Hydroid colony, was relegated in the systems of classification to a distance from all its nearest of kin.

This primary and inevitable mistake has introduced a large amount of confusion into this department of zoology, and we are only now escaping, in part at least, from the effects of it.

The most important result of recent investigation has been the union of the Hydroid zoophytes and the naked-eyed Medusæ of authors in one great natural group. The two forms of structure embraced in this division, the one represented by the *Hydra*, and the other by the (so-called) *Jelly-fish*, which appeared so dissimilar when only known in isolation, are now proved to be essentially identical: the fixed and floating polypites are but different phases of one and the same organism. And these elements are variously manifested and combined in the Hydroid group. In some cases there are fixed zooids (alimentary polypites) and free zooids (sexual polypites) developed from the same stock, and constituting one (zoological) individuality. In other cases there are two classes of fixed zooids, the nutritive and reproductive, permanently united; in others, again, there are only free zooids (floating polypites) in which the nutritive and sexual functions are combined. But these are in reality nothing more than variations of one and the same structural group.

There has been considerable diversity of opinion as to the true position of the small number of medusan* forms that are developed directly from the ovum without the intervention of any fixed Hydroid stock. But they certainly

* This term is employed here and elsewhere as an adjective, descriptive of a certain modification of Hydroid structure.

present no structural peculiarities that would entitle them to stand alone, and are rightly merged in the Order, which includes so many kindred zooidal forms. Agassiz and Fritz Müller have taken this view[†]; and Carus, in his admirable classification of the *Cœlenterata*, has referred them to the Hydroida, though he has placed them in a distinct group (*Haplomorpha*), apart from the forms into whose life-history the two elements enter. Huxley proposes a separate Order for the naked-eyed medusæ that are developed directly from the eggs of similar organisms; but the absence of the fixed-polypite stage can hardly be accounted more than a generic character when it is remembered that the *Lizzia* observed by Claparède, the eggs of which produce medusæ, is identical in structure with the sexual zooid of the Campanularian *Leptoscyphus* (Allman). I can see no reason whatever for detaching the medusan forms developed directly from the ovum, and not as buds on a fixed stock, from the Hydroida, either as a separate order, or even as a secondary section. To the latter they are bound by the closest structural affinities; and instead of dismembering the Hydroid group on the ground of this difference in the mode of development, it is surely more philosophical to enlarge our conception of its range.

I have therefore rejected Carus's subgroups *Haplomorpha* and *Diplomorpha*, and have preserved the simple unity of the order *Hydroida*. The present work, however, embraces only the medusan forms that have been traced to a fixed Hydroid stock.

Another result to which we have been brought by our increased knowledge of Cœlenterate structure is the recognition of the close affinity subsisting between the Siphono-

phora (Eschscholtz) and the Hydroida proper. The relationship is masked by the striking difference in habit and general aspect between the two groups; but the restless ocean vagrants and the stationary, plant-like beings that seem to offer the most complete contrast to them are essentially identical in structure, and the leading peculiarities of each group are only modifications of that structure adapting it to various modes of life.

At certain points of the Hydroid series, the apparent dissimilarity is much less marked; and a colony of *Hydractinia* or *Podocoryne* very plainly betrays its affinity to *Velella* or *Physalia*.

Carus has ranged the *Siphonophora* and the *Hydroida* proper, as separate groups, under his order *Hydromedusæ*. Agassiz unites the two as a single order, constituting suborders for the leading divisions of each.

Huxley, who is followed by Greene, divides the *Siphonophora* into two groups, *Calycophoridae* and *Physophoridae*, which he regards as orders of his Class *Hydrozoa*, parallel with the *Hydridæ*, *Corynidae*, and *Sertulariadae*, and with the *Lucernariadae*, including the covered-eyed Medusæ of Forbes*, and *Lucernaria*.

All these arrangements recognize the close affinity of the *Siphonophora* and *Hydroida*, and differ only in the details of their grouping.

In the present work the first three of Prof. Huxley's orders, *Hydridæ*, *Corynidae*, and *Sertulariadae*, are treated as suborders, and constitute together the order Hydroida.

It seems to me clear that these divisions have no claim to be considered groups of equal value with the *Discophora* (*Lucernariadae* of Huxley).

* *Steganophthalmata*, Forbes; *Phanerocarpæ*, Esch.; *Acraspeda*, Gegenbaur.

The *Calycophoridae* and *Physophoridae* I should also rank as suborders, and unite in the single order *Siphonophora*. The *Medusidae* of Huxley, under which he has ranged the naked-eyed Medusæ that have not yet been traced to a Hydroid stock, and those which are known to be developed directly from the ovum, according to the views already stated, should cease to constitute a distinct group. For the *Steganophthalmata* (Forbes) with *Lucernaria*, which form the third of the orders of Hydrozoa, *Discophora* seems to me a better designation than *Lucernariade*, which has been adopted by Huxley, and which is derived from a strikingly aberrant form.

In classifying the Hydroida and constructing the generic groups, respect must be had, as emphatically pointed out by Allman*, to both the nutritive and reproductive elements. It is much easier, however, to recognize the correctness of this principle in the abstract than to apply it practically to the work of the systematist; for the affinities suggested by one of these elements are, in many cases, by no means affirmed by the other.

The trophosomes of two species may agree very closely in character, while the gonozooids are widely dissimilar, and *vice versa*. To take a striking illustration: the reproductive zooid of *Corynopsis*, a genus which ranks in the family of the *Podocorynidae*, is identical when first liberated with that of *Bougainvillia*, a member of the family *Atractylidae*†. So *Syncoryne eximia* and *Stauridium productum*, which are referred to different genera from the dissimi-

* In his valuable paper "On the construction and limitation of genera among the Hydroida," Ann. N. H. for May 1864.

† By an error, *Bougainvillia* is referred, on page 35, to the family of the *Eudendriidae*.

larity in the polypites, originate medusiform gonozooids which are not merely alike, but identical at the time of detachment*. In these examples the trophosomes are dissimilar, whilst the gonosomes agree. But the cases are much more numerous in which the alimentary zooids exhibit the closest relationship, while the gonozooids present differences that would be commonly accounted generic. Amongst the *Corynidae*, three genera (*Coryne*, *Syncoryne*, and *Zanclaea*) are undistinguishable one from the other, so far as the trophosome is concerned. In the large and beautiful family *Campanulariidae*, all the generic groups, with a single exception, are founded on characters supplied by the gonosome alone; and many similar cases might be cited.

Perfect agreement in the alimentary characters does not of necessity imply agreement in the sexual characters; whilst, on the other hand, the trophosomes may be strikingly unlike, and the gonozooids identical.

Our system of classification must be harmonized with these perplexing facts; and it is hardly a paradox to say that in some respects it may appear less *natural* if strictly conformed to the order of nature.

It may be remarked, in passing, that in some genera the differences between the species are chiefly exhibited in the trophosome, and the gonozooids are almost, or altogether, identical. This is remarkably the case in the

* A. Agassiz (in his 'Cat. of North American Aculephæ, 1865) expresses his belief that at a more advanced stage these gonozooids would exhibit differences—and will not allow that "medusæ generically identical" are "developed from Hydroids generically distinct." Since the publication of his work, however, observations have placed it beyond doubt that many cases occur in which the gonosomes are identical, while the trophosomes present differences that must be accounted generic.

genera *Syncoryne* and *Perigonimus*, and more or less so in several others. In such groups the alimentary portions of structure would seem to have been more susceptible of modification than the reproductive.

In constituting the genera, I have endeavoured to give due weight to the different structural elements. I have followed Agassiz and Allman in regarding the presence or absence of a free sexual zooid as a character of generic value, though the adoption of this view leads to the separation of species that in all else are most nearly allied. But I must most strongly dissent from the practice of those authors who have multiplied divisions on the ground of slight variations in the gonozooid*.

The three suborders under which I have distributed the British Hydroida correspond with the *Tubularina*, the *Sertularina*, and the *Hydrina* of Johnston; but I have thought it better to introduce significant titles for these higher divisions rather than to ring the changes on the names of the typical genera.

The character which distinguishes the first suborder, *Athecata* (the naked condition of the polypites), is associated with great diversity in the configuration of the body and the structure and disposition of the tentacles. A rich variety of shape and colour characterizes the polypites of

* There has been a tendency amongst some writers to pay almost exclusive attention to the medusan element, both in their description and classification; but the nutritive and reproductive structures are coordinate, and due regard must be had to both, if we are to form a just conception of the individual Hydroid, or of the affinities and relationships of the Hydroida.

On the subject of classification, reference may be made to two admirable and exhaustive papers in the 'Natural History Review,' Nos. xi. and xii., for July and October, 1863, which are devoted to a review of the 4th vol. of Agassiz's 'Contributions,' and discuss very fully and with great ability the various questions connected with the systematic arrangement of the Hydrozoa.

this division. Amongst the *Thecaphora*, on the contrary, they exhibit very little variation, and the tentacles are invariably filiform and arranged in a single wreath. A like uniformity prevails in the position of the gonophores throughout the latter suborder; they are always borne on a columnar offshoot from the cœnosare, which is homologous with the proliferous polypite amongst the Athecata, whether fully developed or more or less atrophied.

The *Thecaphora* are remarkable for their plant-like growth and the elegance of their forms.*

The following Table exhibits the scheme of classification adopted in the present work:—

Subkingdom CŒLEENTERATA, Frey & Leuckart†.

Class HYDROZOA, Huxley.

Ord. I. HYDROIDA. Ord. II. SIPHONOPHORA. Ord. III. DISCOPHORA.

Order I. **HYDROIDA.**

Suborder I.—**ATHECATA.**

Hydroida destitute of true thecæ or protective cases, either for the polypites or gonophores.

Family I.—**Clavidæ.**

CLAVA, Gmelin.

TUBICLAVA, Allman.

TURRIS, Lesson.

CORDYLOPHORA, Allman.

* These two suborders correspond with the *Gymnogonial* and *Angiogonial* divisions of Allman. The terms here employed seem to me to have this advantage, that they are more general in their application, and may be taken to apply both to the trophosome and the gonosome.

† Beiträge zur Kenntn. der wirbellosen Thiere, von Frey u. Leuckart, p. 37.

Family II.—Hydractiniidæ.

HYDRACTINIA, Van Beneden.

Family III.—Podocorynidæ.

PODOCORYNE, Sars.		? CIONISTES, Wright.
CORYNOPSIS, Allman.		

Family IV.—Laridæ.

LAR, Gosse.

Family V.—Corynidæ.

CORYNE, Gaertner.		ZANCLEA, Gegenbaur.
SYNCORYNE, Ehrenberg.		

Family VI.—Stauridiidæ.

CLADONEMA, Dujardin. | STAURIDIUM, Dujardin.

Family VII.—Clavatellidæ.

CLAVATELLA, Hincks.

Family VIII.—Myriothelidæ.

MYRIOTHELA, Sars.

Family IX.—Eudendriidæ.

EUDENDRIUM, Ehrenberg.

Family X.—Atractylidæ.

ATRACTYLIS, Wright.		BIMERIA, Wright.
PERIGONIMUS, Sars.		DICORYNE, Allman.
HYDRANTHEA, Hincks.		HETEROCORDYLE, Allman.
GARVEIA, Wright.		BOUGAINVILLIA, Lesson.

Family XI.—Tubulariidæ.

TUBULARIA, Linn.		CORYMORPHA, Sars.
ECTOPLEURA, Agassiz.		

Family XII.—Pennariidæ.

VORTICLAVA, Alder.		ACHARADRIA, Wright.
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Suborder II.—THECAPHORA.

Hydroida furnished with thecæ.

Family I.—Campanulariidæ.

CLYTIA, Lamouroux.		LOVÉNELLA, Hincks.
OBELIA, Pér. & Lesueur.		THAUMANTIAS, Esch.
CAMPANULARIA, Lamk.		GONOTHYRÆA, Allman.

Family II.—Campanulinidæ.

CAMPANULINA, Van Ben.		OPERCULARELLA, Hincks.
ZYGODACTYLA, Brandt.		

Family III.—Leptoscyphidæ.

LEPTOSCYPHUS, Allman.

Family IV.—Lafoëidæ.

LAFOËA, Lamouroux.		SALACIA, Lamouroux.
CALYCELLA, Hincks.		FILELLUM, Hincks.
CUSPIDELLA, Hincks.		

Family V.—Trichydridæ.

TRICHYDRA, Wright.

Family VI.—Coppiniidæ.

COPPINIA, Hassall.

Family VII.—Haleciidæ.

HALECIUM, Oken.		OPHIODES, Hincks.
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Family VIII.—Sertulariidæ.

SERTULARELLA, Gray.		HYDRALLMANIA, Hincks.
DIPHASIA, Agassiz.		THUIARIA, Fleming.
SERTULARIA, Linn.		

Family IX.—Plumulariidæ.

ANTENNULARIA, Lamk.		PLUMULARIA, Lamk.
AGLAOPHENIA, Lamx.		

Suborder III.—GYMNOCHROA.

Hydroida destitute of polypary; locomotive.

Family I.—Hydridæ.

HYDRA, Linnæus.

Agassiz, on the strength of observations made on the *Millepora alcicornis*, Linn., proposes to transfer to the Hydroida the coral-making group of the Tabulata, which has hitherto ranked amongst the Actinozoa. He also conjectures that the Rugosa of Milne-Edwards belong to the class Hydrozoa.

BRITISH HYDROIDA.

Suborder I.—ATHECATA.

TUBULARINA, Ehrenberg, Corall. des rothen Meeres, 70 ; Johnston, Brit. Zooph. i. 29.

CORYNIDÆ (order), Huxley, Oceanic Hydrozoa, 21.

TUBULARIÆ, Agassiz, N. H. U. S. iv. 338.

GYMNOTOKA (except *Hydra*), J. V. Carus, Handbuch der Zoologie, ii. 560.

Family I.—Clavidæ.

POLYPITES *claviform or fusiform, with scattered filiform tentacula.*

Genus CLAVA, Gmelin.

Der. *Clava*, a club.

CORYNA, Ehrenberg, Corall. d. rothen Meeres, 69.

GENERIC CHARACTER.—*Polypites clavate, contractile, with many scattered smooth tentacula, rising from a filiform stolon, sheathed in a chitinous polypary, which also invests the base of the polypite: reproduction by means of fixed sporosacs, borne singly or in clusters on the body, behind the posterior tentacles.*

THE species of *Clava* are all strictly littoral, and are found on stones and weed between tide-marks.

We are indebted to Dr. Strethill Wright* for correcting the error of previous naturalists, who had universally described the polypites of this genus as naked and single. The polypary is slightly developed, forming a delicate sheath round the creeping fibre, and rising into a little cup at the base of the polypites.

Reproduction is diœcious, the male and female gonozooids being borne by distinct colonies. The gonophore is of very simple structure, and destitute of investing capsule. Each ovary produces one or two ova, which are developed into ciliated planuloid embryos.

The genus has representatives in the New and Old Worlds. It ranges to North America, and is widely distributed through the North of Europe, having been observed in Norway, Denmark, the Färö Islands, the Skagarrack, the Baltic, and Belgium, as well as on our own shores. It is not included in Sars's 'Mediterranean Littoral Fauna.' All the known species occur in Britain.

1. *C. MULTICORNIS*, Forskål.

HYDRA MULTICORNIS, *Forsk.* Descriptiones Animalium, &c., 131; and Icones Rerum Naturalium, pl. 26. figs. B, b.

CORYNE SQUAMATA, *Couch*, Cornish Faun. iii. 11, pl. i. fig. 1; *Van Beneden*, Rech. sur les Tubulaires, 60, pl. v.

CLAVA MULTICORNIS, *Johnston*, Brit. Zooph. 30, pl. i. figs. 1-3.

„ REPENS, *T. Strethill Wright*, Edinb. New Phil. Journ. (N. S.) for July 1857, pl. ii. fig. 1.

„ DISCRETA, *Allman*, Ann. N. H. Nov. 1859.

Plate I. fig. 1.

POLYPITES *separate, ranged at irregular intervals along*

* On *Clava*, Ed. N. P. Journ., N. S. vi. (July 1857).

the creeping filiform base, white, rose-, or flesh-coloured, with numerous tentacles; GONOPHORES round, hanging in many-pedicle clusters immediately behind the lower tentacles.

Height about $\frac{1}{4}$ inch.

AFTER much consideration I venture to assign Forskål's name to the common *Clava* of our coasts, with scattered polypites. I admit at once that it is difficult to arrive at a conclusion, and that there is room for diversity of opinion. Forskål's description becomes hopelessly obscure at the very point where it should be clearest, and I can only urge that the interpretation which I put upon his words is as good as any other that can be offered. His figure, however, though poor, seems to me intelligible enough, and I have no doubt that it was suggested by the present species. Probably he may have confounded, as other naturalists have done, the scattered and the clustered forms. The *Hydra squamata* of Müller is one of the clustered species, and both his description and figure are excellent. It is desirable to retain for the science, if possible, both these early and well-known names; and I therefore propose relying chiefly on the figure to connect Forskål's with the scattered form, and to refer Müller's to one of the species with clustered polypites.

The number of arms in this pretty species, as amongst all the Hydroids of this suborder, varies with age. It ranges up to 30 or 40. The prevalent colour of the polypites is a rich rose, and there are few more beautiful sights of the kind than a fine colony of this zoophyte overspreading the surface of some tide-pool stone. The oral extremity is opaque white. The anterior portion of the body is endowed with great mobility, and materially assists the tentacles in the capture of prey. The latter are slightly enlarged at the tip, which is covered with

minute hairs—the *palpocils*, or organs of touch. The extremity of the tentacle possesses great prehensile power, and the Annelid or small Crustacean which may come in contact with it is at once made captive and firmly held in spite of its struggles.

Hab. Generally distributed on our coasts, between tide-marks, commonly on stone. It is abundant in Devon and Cornwall, and has been noticed in the Frith of Forth (Wright), the Orkneys (Allman), and in Shetland (A.M.N.).

2. C. SQUAMATA, Müller.

HYDRA SQUAMATA, *Müller*, Zool. Dan. i. 3, tab. iv. figs. 1–3.

CORYNE SQUAMATA, *Lamk.* An. sans Vert. (2nd edit.) ii. 73.

CLAVA MEMBRANACEA, *T. S. Wright*, Ed. New Phil. Journ. (N. S.) for July 1857, pl. ii. figs. 2, 3.

Plate I. fig. 2.

POLYPITES *in dense clusters, springing from a crust composed of delicate membranous tubes agglutinated together, tall, expanding above, of a rich reddish tint, with numerous white tentacula, the clusters united by a simple, filiform stolon; GONOPHORES forming a broad and very prominent collar round the body.*

Height of the polypites in extension from half an inch to an inch.

I HAVE little doubt that this form, which has been characterized by Wright under the name of *C. membranacea*, is the *Hydra squamata* of Müller. In all important points it agrees with the species so well described in the ‘Danish Zoology;’ and even the peculiar character of the crust is indicated, when the author says of the polypites, “*ope microscopii ex materia mucida fucum vestiente, ortum sumere videntur.*” Müller found his *Hydra* on the *Fucus*

vesiculosus; and this seaweed is the common habitat of the British species that I have identified with it.

In *C. squamata* the polypites are closely massed together, and form colonies on the fronds of the *Fucus*, the larger of which measure about half an inch across. They are tall, and expand from the base upwards, thickening considerably towards the tentacles. Under the microscope the body appears lineated longitudinally, especially in the older polypites. The tentacles are pellucid white, and number about twenty in the adult*. The gonophores hang in large bunches below the posterior tentacles, and form a massive and conspicuous collar. Individually they are of considerable size, and almost spherical in form.

The crust that supports each colony is made up of many tubes massed together; and the upper surface of it is completely covered with the cup-like extensions of the polypary, from which the polypites rise; these give it a honey-combed appearance when the polypites are removed. The tubes are of extreme delicacy, and composed not of solid chitine, but of a soft membranous material. The colonies do not generally stand alone: the tubular basis sends off slender, filamentary prolongations, which creep along the weed and give rise at intervals to new clusters.

Hab. Quenserry, Firth of Forth, on *Fucus vesiculosus* (T.S.W.): Lerwick, low water, on the same weed (A.M.N.).

[Denmark, on *Fucus vesiculosus* (Müller).]

3. C. CORNEA, T. S. Wright.

Edin. New Phil. Journ. (N. S.) for July 1857, pl. ii. fig. 4.

Plate I. fig. 3.

POLYPITES *clustered, slender, slightly tapering, of a reddish-*

* Müller gives the number 6-15.

brown (?) colour, with about 20 white, tapering tentacula, borne on an adherent crust, composed of chitinous tubes cemented together into a solid plate; GONOPHORES in rather small bunches, forming a somewhat narrow ring round the body.

C. CORNEA is a smaller and slighter species than the preceding. The polypites are more delicately formed and want the broad expansion towards the upper part of the body; they taper gradually, and not very markedly, downwards. I can only speak doubtfully of the colour, as I have not examined living specimens; but I should judge it to be a reddish brown. The clusters appear much less dense and massive than those of *C. squamata*. This is due not only to the fact that the polypites are less closely packed together, but also to the inferior size of the belt of reproductive buds, which is enormous in *C. squamata*, and of very moderate dimensions in the present species. I have not noticed the lineated appearance in the polypites of *C. cornea*. The crust is a solid chitinous plate, of a decided horn-colour, made up of many tubes intertwisted or laid side by side, and cemented together. The tubes are larger and made of much firmer material than those of *C. squamata*.

The two species, though allied, differ widely in general aspect, as well as in the details that have been referred to.

Hab. The Orkneys, on *Fucus* (Goodsir): Scotland, on seaweed (Prof. Wyville Thomson).

4. *C. LEPTOSTYLA*, Agassiz.

Contributions to the Nat. Hist. of the U. S. iv. 218, pl. xxi. and fig. 32, p. 222.

Plate II. fig. 1.

POLYPITES set closely together, forming moss-like bunches

on the creeping stems, which are usually agglutinated together in a mass, *very tall and graceful, the body much attenuated for a short distance (about $\frac{1}{30}$ of an inch) above its origin, after which it suddenly increases in diameter to about three times that of its base*, and rises to the height of half an inch in full-grown specimens, with a very slightly tapering outline; tentacles not less than 35 in the adult, arranged in a close spiral, tapering, pointed, very long, and slender; GONOPHORES round, forming compound raceme-like bunches, which sometimes occupy one-third of the length of the body, but more commonly are crowded at the upper part.

THE above description is based on the account of this species given by Agassiz in his great work on the Natural History of the United States. I owe it to the kindness of Mr. F. H. West, of Leeds, that I am able to make this interesting addition to our British list. He was good enough to send me some time ago a very fine specimen of a *Clava*, which he had obtained from Morecambe Bay. The remarkable size and gracefulness of the polypites at once arrested my attention; and a little examination disclosed the slender and stalk-like base of the body, which is so marked a character of the *C. leptostyla*. This specimen, which formed a crowded colony on the surface of a mussel-shell, lived with me for some time, so that I was able to make careful observations upon it; but, unfortunately, my notes have been mislaid, and I retain little but the general impression of its striking beauty. I add a few particulars, taken from Agassiz's detailed description:—

“The creeping stems are usually so closely interwoven and agglutinated to each other by their horny sheaths that, owing to the density of the mass, they cannot be easily distinguished as tubular bodies; but upon the out-

skirts of the group, where they are youngest, each one may be traced separately."

The polypites are "highly contractile, and capable of assuming a variety of shapes." When very lively the body "is stretched to the utmost, with elongated head and extremely attenuated tentacles; at other times . . . the head is depressed to a flat-topped disk, from which the tentacles radiate nearly in one plane, like the spokes of a wheel." "When disturbed, the whole body assumes the most contracted condition; the stem and head shorten, and the tentacles retract towards their bases, even to such an extent as to be only three times longer than thick, whilst the inner surface of the chymiferous cavity becomes deeply plicated in obliquely transverse folds, which look like spiral semipartitions." This was very apparent in my specimens*.

The gonophores are borne on pedicels, 10, 15, 20, or 25 of which "spring from a large, thick and short peduncle, which projects directly from the sides of the body. This form of grouping may be compared to a very short raceme, as the term is used in reference to plants. Usually these bunches are attached to the stem, nearly on the same level, and just below the tentacles; but frequently the crowded groups extend downward, either continuously or in detached masses, over one-third of the distance towards the base."

Agassiz speaks of *Clava leptostyla* as forming "little,

* Montagu, in an unpublished work now in the possession of the Linnean Society, mentions a similar peculiarity as presented by a *Clava* which he identifies with the *Hydra squamata*, and had found on the leaves of *Fucus vesiculosus* in the estuary of Kingsbridge, South Devon. "When examined by a lens," he says, "the intestinal canal is observed to be undulatory or spiral, and appears to be the coloured part of the body, the exterior part being hyaline." This is the only record, I believe, of the occurrence of a *clustered Clava* in Devon; and it is not improbable that the species observed by Montagu was the *C. leptostyla*.

red, moss-like bunches" on *Fucus vesiculosus* at low-water mark, where they are exposed to the dash of the breaking surf.

Hab. On a mussel-shell from Morecombe Bay (F. H. West).

[North America (Agassiz).]

5. *C. NODOSA*, T. S. Wright.

"Observat. on British Zoophytes and Protozoa," Edinb. N. Phil. Journ. (New Ser.) xvi. 154.

POLYPITES single, small, aurora-coloured, *each springing from a small knot of convoluted tubes*; POLYPARY membranous.

"THE very delicate threads of the polypary creep over the fronds of the seaweed, and at intervals twine themselves into a convoluted knot of membranous tubes, from which a single polyp arises. This species occurs only at low-tide mark, while *C. repens* [*multicornis*], for which it may be mistaken, is found in shallow rock-pools" (T. S. W.).

Hab. On the fronds of *Delesseria sanguinea*, at Queensferry and Largo (T. S. W.).

6. *C. DIFFUSA*, Allman.

Ann. & Mag. N. H. (3rd ser.) xi. 8 (Jan. 1863).

POLYPITES *very slender, of a light rose-colour*, developed at intervals upon a reticulated stolon; tentacula about 20; GONOPHORES *scattered*, some produced just behind the posterior tentacula, others extending singly or in small clusters for some distance backwards upon the body of the polypite.

Height about $\frac{1}{4}$ inch.

I GIVE this species on the authority of Prof. Allman, and

must confess to some doubt as to its validity. The principal character that separates it from *C. multicornis* is the diffusion of the reproductive bodies. But this occurs occasionally in other species, and can hardly be accounted a character of much significance. Müller* represents such a condition in his figure of the *Hydra squamata*; and Agassiz†, in his account of *Clava leptostyla*, says that the bunches of reproductive buds frequently extend downward, either continuously or in detached masses, over one-third of the distance below the base of the tentacles. Possibly we may have in *C. diffusa* a species of which this is the normal and constant characteristic; but at present I am inclined to regard it as a mere variety.

It is right to add that Prof. Allman found the clusters of gonophores scattered in *all* the zooids of the colony which he examined. The polypites, too, were attenuated, and of a delicate rose-colour.

Hab. In rock-pools at low water of spring tides. Outskeries, Shetland Isles (G. J. A.).

Genus TUBICLAVA, Allman.

Der. *Tubus*, a tube, and *Clava*, the name of a Hydroid genus.

GENERIC CHARACTER.—*Stems erect, simple or branched, given off at intervals from a creeping stolon; the whole cœnosarc invested by a polypary; polypites claviform, with scattered filiform tentacula: reproduction by means of fixed sporosacs, borne in clusters on the body of the polypite, immediately behind the posterior tentacula, or on the summit of very short stems developed on the creeping base.*

THE genus *Tubiclava* is most nearly allied to *Clava*.

* Zoologia Danica, pl. iv.

† N. H. United States, vol. iv. p. 222, fig. 32.

It differs from it in having the polypites elevated on distinct stems, clothed with a polypary. There is also, as Prof. Allman has remarked, an affinity between it and *Cordylophora*.

I have so far modified the diagnosis as to make the genus include the *T. cornucopiæ*, Norman, and have given the grounds of the change in my account of that species.

1. *T. LUCERNA*, Allman.

"Notes on the Hydroida," Ann. N. H. (3rd ser.) xi. 9 (Jan. 1863).

STEMS quite simple, or rarely with a short lateral branch; polypary corrugated, dilated at the base of the polypite, pale yellowish brown; POLYPITES when extended about equal to the stem in height, *white, with pale-ochreous centre; tentacula about 20, confined to the anterior third of the body; GONOPHORES borne in clusters behind the lowest tentacles*, and exactly resembling those of *Clava*. Zoophyte about 2 lines in height.

Hab. Creeping over loose stones in a rock-pool, Torquay: on stones between tide-marks, Dublin Bay (G. J. A.).

2. *T. CORNUCOPIÆ*, Norman.

TUBICLAVA CORNUCOPIÆ, *A. M. Norman*, Ann. N. H. (3rd ser.) xiii. 82 (Jan. 1864), pl. ix. figs. 4, 5.

MERONA CORNUCOPIÆ, *Norman*, Ann. N. H. (3rd ser.) xv. 262 (April 1865).

Plate II. fig. 2.

STEMS about a fifth of an inch in height, invested by a small trumpet-shaped tube, very slightly curved, which is somewhat transparent and more or less encircled by raised lines of growth; POLYPITES *greatly elon-*

gated; tentacles numerous, *scattered over the whole of the club-shaped head*; GONOPHORES *in mulberry-like masses, borne on very short stems, which are situated in openings in the creeping base (rudimentary tubes).*

MR. NORMAN has, with considerable hesitation*, constituted the genus *Merona* for the reception of this species at the suggestion of Prof. Allman. The only difference between it and *Tubiclava* is to be found in the position of the sporosacs, which, instead of forming clusters on the body of the ordinary polypites, are massed together at the extremity of short stems (*gonoblastidia*).

The character of the polypary, of the polypites, and of the sporosacs themselves is identical in the two, and I confess I am unable to see any sufficient ground for separating them.

The degree in which the fertile polypite may be atrophied in the discharge of its functions does not seem to be a point of much significance. In some cases it is fully developed at first, but the head and tentacles are absorbed as the reproductive bodies advance towards maturity, and it is converted into a (so-called) *gonoblastidium*. In *Eudendrium capillare* (Alder) the male sporosacs at least always occur in umbelliform clusters; yet Prof. Allman himself has abandoned the genus *Corymbogonium*, which he had based on this peculiarity. *Tubiclava cornucopiæ* bears much the same relation to *T. lucerna* as *E. capillare*† does to the members of its genus which carry the sporosacs round the base of a perfect polypite, and should not be separated from its true kindred on the

* "It . . . still appears to me questionable whether the exact position of the gonophores is a sufficient ground on which to establish a genus." —Ann. N. H. for April 1865.

† The *Eudendrium arbuscula* (Wright) and other species present the same structure as *E. capillare*.

ground of this trifling difference. If the genus *Merona* were adopted, we must dismember the very natural group of forms now included under the genus *Eudendrium*.

Hab. “*Tubiclava cornucopiæ* was dredged in from 80 to 100 fathoms, about 20 miles north of Unst in Shetland, and was parasitic on the shells of *Astarte sulcata* and *Dentalium entalis*. It is worthy of remark that in every instance the Hydrozoon was observed upon shells still occupied by the living Mollusca, and that it invariably had assumed a position at the posterior extremity of the shell, where it would receive the benefit of the aqueous currents caused by the mollusk, which, while providing for its own necessities, thus unwittingly performed the kindly office of feeding its hungry neighbour” (Norman) : coast of Northumberland, “on the posterior end of a *Dentalium entalis*” (J. A.)

Genus TURRIS, Lesson.

Der. *Turris*, a tower.

GENERIC CHARACTER.—*Stems short, rooted by a filiform stolon, bearing the polypites on their summits; the cœnosarc invested by a polypary; polypites claviform, with scattered filiform tentacles.*

Gonozoid free and medusiform. Umbrella subcylindrical, with 4 or 8 longitudinal bands; manubrium massive, four-lipped; radiating canals 4; marginal tentacles numerous, each with an ocellated bulbous base.

T. NEGLECTA, Lesson.

TURRIS NEGLECTA (the free zooid), Lesson, Prodr. No. 38; Acal. Hist. 284; Forbes, Brit. Naked-eyed Medusæ, 23, pl. iii. fig. 2; Gosse, Devonsh. Coast, 348, pl. xiii. figs. 6-10; Allman, Ann. N. H. (3rd ser.) xiii. 352 (May 1864).

CYANÆA COCCINEA (free zooid), *Davis*, Ann. N. H. vii. (1841) 234, pl. ii. fig. 1, 2, 3.

CLAVULA GOSSII (the polypite), *T. Stretbill Wright*, Edin. New Phil. Journ. (N. S.) for July 1859, pl. viii. fig. 1.

Plate III. fig. 1.

POLYPITES minute, of a crimson colour, borne on short stalks, which rise at intervals from the creeping stolon; tentacles about 12, the upper row long, four in number, erect, the rest scattered, shorter, inclined upwards.

GONOOID.—UMBRELLA, in the mature zooid, subhemispheric, slightly pointed above, transparent, smooth, with four longitudinal bands; MANUBRIUM of a rich crimson when laden with the ova,—the mouth with four lips, which are fimbriated at their edge; MARGINAL TENTACLES more than 60 in number, closely set, very contractile, each of them springing from a large bulbous base, on the upper part of which is a brilliant crimson ocellus.

THE sexual zooid of this species has long been known, having been described by Lesson in 1837 as an independent animal. Forbes gives it a place amongst his naked-eyed Medusæ, and celebrates its beauty. In its native element it “is brilliant as a bead of brightest coral.” Mr. Gosse obtained the first clue to its history in 1852, having observed the escape of the embryos from the ovary and their subsequent development into minute polypites. Dr. Wright was afterwards fortunate enough not only to rear the polypites, but also to keep them until they had attained their perfect form. We are still ignorant of the position in which the reproductive bodies are developed, and of their early history.

The embryo is oval, dark crimson in colour, and ciliated. After becoming attached it is developed into a branching stolon, from which perpendicular stems originate, bearing polypites with four long and straight tentacles. The further

change consists in an increase of the number of arms, which are scattered over the body as in *Clava*.

Hab. In the Solent and around the Isle of Wight, not uncommon: the West Bay of Portland (Forbes): Tenby (Dr. J. F. Davis); Ilfracombe (Gosse): Queensferry, Firth of Forth (T. S. W.).

Genus CORDYLOPHORA, *Allman*.

Der. κορδύλη, a club, and φέρω, I bear.

SYNCORYNA, Agassiz, N. H. U. S. iv. 339.

GENERIC CHARACTER.—*Stem well-developed, branching, rooted by a filiform stolon; the whole of the cœnosarc invested by a chitinous polypary; polypites fusiform, developed from the extremities of the branches, with scattered filiform tentacula: reproduction by means of fixed sporosacs, borne on the stem, never on the polypite.*

THE genus *Cordylophora* is peculiarly interesting, as containing the only composite Hydroids that have been found in fresh water. It seems, however, to be equally at home in brackish water. The *C. albicola* (Kirchenpauer) grows on buoys at the mouth of the Elbe; and Lindström has obtained *C. lacustris* in the half-saline waters of the Baltic amidst a curious assemblage of marine and fluviatile plants and animals. In this locality it grows on the stems of *Myriophylla*. *Paludina impura*, fresh-water *Entomostraca*, and the larvæ of insects abound. Associated with these is the *Corophium longicorne*, an undoubtedly littoral form, while the *Tergipes lacinulatus*, a thoroughly marine Crustacean, creeps in numbers amongst the branches of the *Cordylophora**.

* *Vide* a paper by Lindström on “the Invertebrate Fauna of the Baltic,” in the ‘*Öfversigt af Kongl. Vetensk.-Akad. Förhandlingar*’ for 1855.

The genus occurs in North America, Prof. Leidy having discovered another species, according to Agassiz, in Newport Harbour, R. I.

Van Beneden has recently studied *C. lacustris*, and supplies some curious illustrations of the voracity of the polypites and their power of dealing with their prey.

Having put some water-fleas (*Daphne*) into the vessels containing the *Cordylophora*, he was surprised in a short time to see these active Crustaceans struggling amongst the arms of the polypites, and soon losing their power of motion, and lying, as it were, paralysed in their solid carapaces. He has also seen worms (*Nais*) and *Planariæ* seized and devoured. The former, though very tenacious of life, yielded rapidly to their assailants, and passed into the digestive cavity of the polypites.

C. LACUSTRIS, Allman.

CORDYLOPHORA LACUSTRIS, *Allman*, Ann. N. H. xiii. (1844) 330; Phil. Trans. for 1853, 367, pl. xxv. and xxvi.; *Johnst. B. Z.* 44, woodc. fig. 5; *Hincks*, Ann. N. H. (2nd ser.) ii. 180 (March 1853), pl. vi. figs. 1, 2.

SYNCORYNA LACUSTRIS, *Agassiz*, N. H. U. S. iv. 339.

Plate III. fig. 2.

STEM slightly flexuous, more or less branched; branches alternate, cylindrical, suberect, annulated above the point of origin; POLYPITES white, ovoid, prolonged above into a conical proboscis, and supported on a fleshy neck, to the base of which the chitinous polypary extends; tentacles 12-14; GONOPHORES oval, sessile, invested by a delicate chitinous covering, generally from one to three on each branch.

Height between 2 and 3 inches.

THIS is the only composite and plant-like Hydroid which

inhabits our fresh waters. It has been thoroughly investigated by Allman, who has made it the subject of an admirable memoir, which is one of the most important contributions to our knowledge of the structure and physiology of the Athecate Hydroida.

The polypites of *Cordylophora*, when kept in confinement, soon perish, and are soon reproduced. They do not drop off, like those of *Tubularia*, but are destroyed by a process of absorption. The arms are roughened by thread-cells, which are arranged in regular nodules. The polypite, like the Hydra, possesses a remarkable power of elongating and shortening its tentacles. At times they are so much extended as greatly to exceed the entire body in length, and in this state are attenuated into most delicate filaments. When contracted they appear corrugated, and comparatively thick.

The polypite is a singularly beautiful object when the tentacula (some 12 or 14 in number) are all fully elongated, floating like gossamer threads through the water, and waving to and fro with its every slightest movement.

The reproductive buds are produced on the ultimate ramules, at some distance behind the polypite. There are sometimes as many as three on a branch, which are placed alternately, "the more advanced being always nearer to the main stems" (Allman). I have counted twelve ova in a single female capsule, but more commonly the number amounts to six or eight. They are developed into ciliated planulæ, which escape through the ruptured walls of the sac.

On reaching the water the embryo remains inactive for a few seconds, undergoing remarkable changes of shape; the body then acquires a rotatory motion, and it sails off with considerable rapidity. It is elongate-oval in form, somewhat broader at one extremity than the other, opaque white in

the centre, and semitransparent towards the edge of the body, and completely covered with cilia. Planulæ which had made their escape late in the evening, I have found attached on the following morning. The cilia disappear, and they fix themselves by one extremity, which expands into a roundish disk, the body standing erect in the centre of it. This gradually assumes the form of the polypite, the upper portion becoming ovoid and pointed above. Three or four tentacles also sprout from it, while the polypary forms round the basal part. When the stem has reached a certain height, it swells into small protuberances here and there, which soon develop themselves into branches and polypites. At the same time the base sends out creeping shoots, from which fresh stems originate; and the process of germination continues until a whole forest of plant-like structures has been evolved from the single primary zooid.

Hab. On an old submerged boat, Grand Canal, Dublin (G. J. A.): in the Commercial and other Docks, London, on wood, &c. (Dr. Bowerbank): in a cistern at Kensington (Busk): near Lynn Regis (Dr. Low).

[Gälö-strat, Baltic (Lindström): near Stockholm (Retzius): Schleswig (Van Beneden).]

Family II.—Hydractiniidæ.

POLYPITES claviform, sessile, with a single verticil of filiform tentacles round the base of a conical proboscis, borne on an expanded and continuous crust; the cœnosarc naked above.

Genus HYDRACTINIA, *Van Beneden*.

Der. *Hydra*, a genus of Hydroida, and *Actinia*, a Sea-anemone.

ECHINOCHORIUM, Hassall, Annals N. H. for July 1841.

SYNHYDRA, De Quatrefages, Ann. Sc. Nat. xx. 232.

GENERIC CHARACTER.—*Polypites claviform, sessile, with a single verticil of filiform tentacula surrounding the base of a conical proboscis, developed at intervals from the cœnosarc, which forms a naked expansion above, and below consists of a mass of anastomosing stoloniac tubes clothed with a chitinous polypary, which are adnate to one another and form a continuous crust: reproduction by means of fixed sporosacs, which are borne on partially developed polypites*, destitute of tentacles and furnished with many spherical clusters of thread-cells round the oral extremity.*

POLYMORPHISM reaches its height amongst the Hydroida in the genera *Hydractinia* and *Podocoryne*. In each colony of these zoophytes several distinct kinds of zooid with separate functions are united together, presenting a wonderful variety of form and structure. We have in *Hydractinia*, (1) the alimentary polypites, whose sole office it seems to be to procure and digest nutriment for the commonwealth; (2) the fertile polypites, which are small and attenuated and only furnished with rudimentary tentacles, and which support the true reproductive zooids; (3) the fixed reproductive sacs, which differ in shape and colour in the two sexes; (4) the spiral appendages, snake-like organs, endowed with great muscular power, and localized in certain regions of the common basal crust;

* This is not always the case. Gegenbaur mentions that he has found gonophores on fully developed polypites (Grundzüge der vergleichenden Anatomie, p. 99, & p. 94, fig. 15).

and (5) the tentacular filaments, highly extensile thread-like processes with nematocysts at the tip, distributed chiefly on the outskirts of the colony. In *Podocoryne* we have, as a variation, a locomotive sexual zooid.

In studying these remarkable organisms, we are at once reminded of the oceanic Hydrozoa, the complex colonies of which float freely in the open sea. There are many striking resemblances between *Hydractinia* and some of the *Physophoridae*. Both exhibit the same polymorphism; in both the reproductive bodies are borne on peculiarly modified polypites; in both tentacular appendages are developed from the cœnosarc, and a solid expansion supports the community. *Hydractinia* and *Podocoryne*, from the nature of the habitat which they almost invariably select, enjoy the benefits of locomotion, though themselves fixed. They employ the mollusk and the Hermit-crab as their carriers, and to some extent, probably, as their purveyors also.

The expanded crust of *Hydractinia* supporting the curious assemblage of zooids has been investigated by several eminent naturalists, from whom we have had conflicting accounts of its nature and the mode of its formation. Agassiz takes the view that the whole horny mass is a "foot-secretion" just as truly as it is among the gorgonioid polyps—an opinion which had been previously maintained by De Quatrefages. Dr. Strethill Wright, who has thoroughly investigated the history of *Hydractinia*, and who was the first to notice some of the most interesting points of its structure, arrives at the opposite conclusion, that the mode in which the polypary is secreted is essentially the same as amongst other hydroid zoophytes.

There is some difficulty in examining the chitinous expansion, closely adnate, as it usually is, to the body on which the colony is planted. Frequently, however, in the case of old shells tenanted by the *Pagurus*, it is found to

extend for some distance beyond the edge of the shell, and to form a considerable addition to the lip. This portion can be readily removed and submitted to the microscope. A careful examination of this free extension of the crust has yielded the following results:—The upper surface is invested by a white fleshy substance, from which the polypites and spiral organs are developed in large numbers, the latter almost exclusively on the extreme margin. On examination, this soft layer is found to be mainly composed of a multitude of delicate, anastomosing, tubular stolons closely packed together. The surface of the layer is more or less roughened by minute points of chitine, which protrude through it, and, running in lines, mark out the course of the stolonie tubes. At intervals large grooved and murieated spines occur, which are also partially covered by the fleshy crust.

If a portion of the base be divided transversely so that the intimate structure may be examined in section, the following appearances are observable.

Fig. 1.



A large proportion of the slice is seen to be occupied by a chitinous framework (fig. 1, *a a*), the upper side of which is overspread by the fleshy carpet that bears the polypites (fig. 1, *b b*), while the inferior surface is more or less covered by a thin layer of a mucus-like substance

(fig. 1, c). The appearance of the framework itself as seen in section is that of a series of tubes laid side by side on a plate of chitine, and closely appressed one to the other.

The tubular orifices are completely filled in with cœnosarc. Above they rise into many spinous projections so as to exhibit a jagged outline; below they rest uniformly on the chitinous base. Here and there smaller spinous processes are given off from the *under* surface of the latter, and penetrate the mucous layer that invests it.

The structure of the framework seems to be of this kind. From a thin basal lamina of chitine rise numerous chitinous lamellæ, terminating above in serrulated edges, which sometimes run parallel to one another and sometimes anastomose. The spaces between them form the channels in which the soft cœnosarcæal stolons are contained; and from these rise the polypites and the spiral and tentacular appendages. The passages or tubes thus formed are covered in above, not by a solid wall, but by a chitinous network, which stretches across them a little *below* the free serrated edges of the lamellæ.

Through the meshes of this fenestrated covering the fleshy matter passes and forms a superficial layer, filling in the grooves between the ridges and overlying the framework, with the exception of the points of the spinules.

The larger spines owe their origin to the elevation of the tubes at certain points.

The chitinous crust of *Hydractinia*, then, is in no true sense a "foot-secretion;" it is a modification of the ordinary stolonetic base of the hydroid zoophyte, and is secreted in essentially the same way. The peculiarity consists in the reticulated covering of the chitinous tubes, allowing of the outgrowth of the cœnosarc and the consequent formation of a naked superficial layer.

The mode of development will be understood by a

reference to Plate IV. fig. 6, which represents a young polypite in an early stage of growth. Before the formation of the head and tentacles, radical prolongations are given off at the base, which are the beginnings of the stolonetic network. The spaces between them are gradually filled in by the extension of the cœnosarc until they are almost united; but instead of coalescing, they seem to secrete on each side of them the chitinous lamellæ, the spinous ridges of which soon show themselves on the surface*; and the passages thus formed are covered in by a reticulated roof. The free investing layer of the cœnosarc rests upon this roof and conceals it.

In an early period of growth the base of *Hydractinia* appears, according to Dr. Wright's observations, under various forms, and, in some of the conditions which he has described, resembles very exactly that of *Podocoryne* at a corresponding stage. But the development of this portion of the structure requires further investigation.

H. ECHINATA, Fleming.

ALCYONIUM ECHINATUM, *Flem.* Brit. An. 517.

ALCYONIDIUM ECHINATUM, *Johnst.* Br. Z. (1st edit.) 304, pl. xlii. figs. 3, 4.

HYDRACTINIA LACTEA (the male), *Van Ben.* Tubulaires, 64, pl. vi. figs. 7-14.

„ ROSEA (the female), *Van Ben.* Tubul. 63, pl. vi. figs. 1-6.

ECHINOCHORIUM CLAVIGERUM, *Hassall*, Ann. N. H. July 1841, 371, pl. x. fig. 5.

SYNHYDRA PARASITES, *Quatrefages*, Ann. Sc. Nat. xx. 232, t. 8, 9.

HYDRACTINIA ECHINATA, *Johnst.* B. Z. 34, pl. i. figs. 4-6; *T. Stretchill Wright*, Edinb. New Phil. Journ. (N. S.) for April 1857; *idem*, Ann. N. H. for August 1861; *Allman*, Proceed. Royal Soc. Ed. session 1857-58.

„ POLYCLINA, *Agassiz*, N. H. U. S. iv. 227, pl. xvi. (vol. iii.) and pl. xxvi. (vol. iv.) fig. 18.

Plate IV.

CHITINOUS CRUST covered with numerous grooved and

* *Vide* De Quatrefages on *Synhydra*, Ann. Sc. Nat. (2nd ser.) Zool. xx. 245.

serrated spines; ALIMENTARY POLYPITES milk-white, with a variable number of tentacula (20–30 in the adult), which are held in extension, alternately elevated and depressed; FERTILE POLYPITES short and slender, bearing the gonophores in clusters or scattered upon the upper portion of the body; GONOPHORES (male) oblong and pointed above, of a yellowish colour, (female) roundish and rose-coloured,—occasionally developed on the common base; APPENDAGES OF THE CÆNOSARC, long, filamentary organs spirally coiled while at rest, with clusters of thread-cells round the free extremity, and slender, very extensile tentacula distributed singly on the outskirts of the colony.

H. ECHINATA selects for its habitat invariably, so far as I have observed, univalve shells that are tenanted by the Hermit-crab; and there can be no doubt that its alliance with the crustacean, though not essential to its wellbeing, is at least the source of material advantage to it. I have never found it in the situation in which Agassiz describes his *H. polyclina* as frequently flourishing, on rocks in tide-pools, where it sometimes covers, he says, “several square feet with a rosy, velvet-like carpet,” though it also occurs on “the shells of Gasteropods, which serve as a retreat for the Hermit-Crab.” This zoophyte forms a whitish fleecy covering on the shell of the mollusk, involving the greater part of it when finely developed. The waving forest of tall and graceful polypites generally reaches its greatest height towards the mouth, round the edge of which are set the curious snake-like appendages, either coiled up or unrolled and cast out over the orifice like a fringe. Intermingled with the perfect polypites, and commonly present in immense numbers, are the rudimentary zooids, which carry the generative sacs, attenuated by their work, and looking as if weighed down by their burthen. Towards the outskirts of the colony and along the growing edge of

the crust, the polypites are of much smaller size ; and in this region occur the tentacular filaments, which are capable of great extension, and float like long fishing-lines through the water. When not extended, these are so inconspicuous as readily to escape observation. Rising amongst the dense ranks of the polypites is a multitude of serrated spines ; and supporting the whole array of curious and beautiful structures spreads the common crust with its soft overlying carpet of cœnosarc.

A remarkable point in the history of the *Hydractinia* is the amount of sympathy that exists between the zooids composing a colony. This is due to the horizontal fleshy layer which immediately connects them all. It has been noticed that if any part of the common base be irritated the spiral appendages uncoil simultaneously, and lash themselves violently backwards and forwards, and then quickly roll themselves up again*. I have seen a whole company discharge themselves with remarkable energy, and with the precision of a regiment on drill.

After studying the structure and the singular associated movements and the constant position of these bodies, I have no doubt that Dr. Wright is correct in regarding them as special organs of the zoophyte ("forms of a truly definite nature"), notwithstanding the opposite decision of Agassiz.

It is difficult to assign them a function, unless they be, as Dr. Wright has conjectured, "organs of defence or offence." They may, perhaps, be analogous in this respect to the nematophores of the *Plumulariidae* or the curious tentacular appendages of *Ophiodes*.

* *Vide* a very interesting paper on *Hydractinia* in the Edinburgh New Phil. Journ. for April 1857, by Dr. Strethill Wright, to whom we are indebted for the first notice of the spiral and tentacular appendages, and a very accurate and philosophical account of the general structure of this zoophyte.

If we direct our attention to the alimentary polypites, we find that the proboscis is capable of extraordinary distention, and assumes the most protean forms. In its most marked deviation from the normal condition, it presents the appearance of a wide saucer-like disk, the tentacles standing out round the rim. In the prolific polypite the buccal prominence is small and broadly conical, and is often concealed by the clustering masses of thread-cells. I am inclined to think that the mouth is not absolutely suppressed. Dr. Wright speaks of a whitish spot on the tip of the proboscis, through which he has succeeded in forcing "the contents of the intestine;" and Agassiz describes a mouth in his *H. polyclina*, a species which I am unable to distinguish from our own *H. echinata*.

The sporosacs are distributed over the upper part of the body, and attain an immense size as their contents are matured. They are present in all stages of development on the same polypite, one or two being generally much in advance of the rest. The shape and colour vary in the two sexes, the male sporosac being often much elongated and of a yellowish tint, the female roundish and rose-coloured.

H. echinata is liable to be infested by the larvæ of a Pycnogon, which manage in some way or other to take possession of the polypites and convert them into nests, in which they pass through certain stages of their development*. These converted polypites are nothing more than capacious sacs, without tentacles, in which, as in a comfortable nursery, the brood of young Pycnogons spend their early days, feeding no doubt on the nutrient juices of the zoophyte.

* *Vide* a paper by Dr. Strethill Wright, Journ. of Microscop. Science (N. S.) vol. iii.

Hab. On old univalve shells (*Buccinum undatum*, *Fusus corneus*, *Turritella communis*, *Nassa reticulata*, *Littorina*, *Natica*, *Trochus zizyphinus*, &c.) at low-water mark and in deep water; generally distributed.

[Ostend (Van Ben.): Normandy and Brittany, always on shells tenanted by the *Pagurus* (De Quatrefages): North America (Agassiz).]

Family III.—Podocorynidæ.

POLYPITES sessile with a single verticil of filiform tentacula round the base of a conical proboscis.

Genus *PODOCORYNE*, Sars (in part).

Der. *ποῦς*, a foot, and *Coryne*, a genus of Hydroids.

DYSMORPHOSA, Philippi, Erichson's Archiv for 1842, 37, tab. i. fig. 3.

GENERIC CHARACTER.—*Cænosarc* consisting of a network of creeping fibres, clothed with a polypary which also forms a small cup-like investment round the base of the polypites—the network in the adult state filled in with chitine, so as to constitute a continuous crust; polypites sessile, claviform, with a single verticil of filiform tentacula surrounding the base of a conical proboscis; gonophores borne on the body of the polypite below the tentacles, or on the common basis, and originating free, medusiform zooids.

Gonozooid: Umbrella bell-shaped; manubrium shorter than the umbrella, four-lipped, each lobe bearing a tuft of vibratile thread-cells; radiating canals 4; marginal tentacles springing singly from bulbs without ocelli, the first

set placed at the termination of the canals, the number increasing with age, and always a multiple of four.

THE *Dysmorphosa* of Philippi is undoubtedly identical with *Podocoryne*, and his name has precedence in point of time. As, however, Sars's genus must be broken up into two sections (the one including the species in which the sexual zooids become free, the other those in which they continue fixed), both names may be retained. I have assigned *Podocoryne* to the former of these divisions, of which the well-known *P. carnea* may be taken as the type. The other should bear Philippi's name*.

Under *P. carnea* an account is given of the mode in which the common crust is developed in this genus. The early and the later states are so different that they would probably be referred to distinct genera if the intermediate stages of growth had not been observed.

Krohn has described the budding of young from the manubrium of the free sexual zooid, and A. Agassiz has made similar observations on an allied species (*Dysmorphosa fulgurans*). Development takes place with great rapidity, and "buds of the third generation are already forming while the second is still attached."

Agassiz mentions that the latter species is sometimes so abundant that the whole sea, when disturbed, is brilliantly lighted by the peculiar bluish phosphorescent colour which it gives out†. We cease to wonder at the amazing number of these (so-called) Medusæ when we know that they are not only thrown off by hundreds from each densely packed hydroid colony, but that every one of them has the power of producing a family by gemmation.

* Allman has proposed the name *Stylactis* for this section. But as he now recognizes the identity of *Dysmorphosa* and *Podocoryne*, he will probably not deem it desirable to displace either of the older names.

† Catal. of North American Acalephæ, p. 163.

The first set of marginal tentacles consists of four, which are placed at the termination of the radiating canals. The subsequent increase takes place by fours, the largest number thus far observed in any species being 16.

Podocoryne rivals *Hydractinia* in the variety of form that exists amongst its zooids. The degeneration of the fertile polypites is never so complete as in the latter genus, and, indeed, in some cases it has no existence at all. I have shown that the spiral and filamentary appendages are common to both. There is a close relationship between the two genera.

1. P. CARNEA, Sars.

PODOCORYNA CARNEA, Sars, Faun. Litt. Norv. part i. 4, t. i. figs. 7-18.

„ ALBIDA, Sars, ibid. 7.

PODOCORYNE CARNEA, Allman, Ann. N. H. for July 1859 and May 1864 ;
Hincks, Rep. Brit. Assoc. for 1864, (Proc. of Sect.) 99.

Plate V.

POLYPITES *tall*, expanding slightly upwards, white or reddish, with an opaque-white proboscis, *and a variable number (4-30) of long and graceful tentacles*, rising from an incrusting base, thickly covered (in the adult state) with smooth linear spines; GONOPHORES *borne in clusters on the body of the polypites**, a little below the base of the tentacles, pedunculate, containing each a single medusiform zooid.

GONOOID.—UMBRELLA deep bell-shaped, thickly covered with minute thread-cells, and with a wide velum; MANUBRIUM short, reddish, with a tuft of large, vibratile thread-cells on each lobe of the mouth; MARGINAL TENTACLES *eight*, very extensile, springing from red bulbs, four fully developed at the time of liberation, and four more or less rudimentary.

* The fertile polypites are generally, but not universally, smaller than the alimentary, and furnished with fewer tentacles (4-5).

WE have had conflicting accounts of this zoophyte from authors, their discrepencies being due to the fact of their having observed it in different stages of growth. Sars describes the polypites as united together by a kind of inerusting mantle, which after their death remains behind "as a brown epidermal investment, bearing numerous pointed spines of a horny nature." Allman regards this as probably a mistake, and characterizes the hydrorhiza as simply tubular and retiform. But *Podocoryne* presents us with both conditions. In its younger state the polypites rise from delicate milk-white fibres, which run in nearly parallel lines over the surface of the shell that bears the zoophyte, and which are united by cross fibres, forming at first a rather wide-meshed net. These cross fibres increase in number and often anastomose, and gradually the meshes are filled in by a chitinous crust, which appears to involve the tubular basis itself. Numerous pointed spines are developed simultaneously, as it seems, with the growth of the crust; at least I have never noticed them when the stolonie network was perfectly simple. They are not mucated, like those of *Hydractinia*, but smooth. In this way the common base becomes a continuous expansion, thickly studded with spinous processes, as described by Sars, on which the polypites are densely crowded together. I have specimens overspreading the shells of *Nassa reticulata*, that exhibit the two conditions side by side. The delicate milk-white network of fibres covers a considerable portion of the surface; but at certain points the meshes may be seen partially filled in by the crust, while at others they are converted into a solid expansion.

The stolonie portion, then, of *Podocoryne carnea* occurs under the following forms:—(1) as a network of fibres of greater or less complexity; (2) as a network the fibres of which are involved in a chitinous crust, which partially

fills in the meshes, and is set at intervals with spines ; and (3) as a continuous crust bristling with spines.

These facts are interesting, not only as clearing up the discrepancies in the accounts of the species, but as throwing light on the formation of similar structures.

The polypites of *P. carnea* vary in colour ; they are sometimes white or with a slight tinge of yellow, and sometimes reddish. The proboscis is always opaque white, and at the base of it there is often a collar of deeper red.

There is no constant and uniform difference in size and the number of tentacles between those which bear the reproductive bodies and those which do not. Commonly the prolific polypites are smaller than the rest, and are sometimes much dwarfed and attenuated, the number of arms being reduced to 4 or 5. But they occur with 7 or 8, 10, and even 16, and are not unfrequently fully developed in all respects.

The gonophores are produced in large clusters, forming a collar round the body of the polypite, some distance below the tentacles. I have counted 6 in a group ; and Sars gives the number at 8-11.

At the time of liberation the four tentacles, which are a continuation of the radiating canals, are fully developed, and there is generally a smaller tentacle in the centre of two of the interradial spaces. Two more soon bud from the remaining spaces, so as to make the whole number eight ; but no further increase has been observed.

The mouth is divided into four distinct lobes, each of which is furnished with a tuft of thread-cells. These are mounted on extremely delicate peduncles ; and when the mouth is in search of food they are brought into an erect position, and are in constant vibratile motion.

The gonozooid swims by a series of jerks or casts, and carries the arms curled back over the bell.

P. carnea is furnished with the curious spiral appendages first described by Wright as occurring on *Hydractinia echinata*. They are placed in a row round the opening of the shell that supports the hydroid colony, on the edge of the investing crust, and are generally curled up in two or three coils. They have a white central core, and are very slightly enlarged at the free extremity. I have also observed in certain portions of the colony slender filaments springing immediately from the crust, which correspond with the tentacular appendages of *Hydractinia*.

Hab. On stones in rock-pools near low-water mark, and on old shells brought up on the lines of the fishermen, Inch Garvie, Firth of Forth (G. J. A.): on *Nassa reticulata* and *Turritella* off Torbay in moderate depths, and in Swanage Bay, Dorset: Oban, on opereulum of *Buccinum* (T. H.): Cullercoats (J. A.).

The shell of *Nassa reticulata* is the favourite habitat of this species, and I have found it generally present on specimens taken up with the dredge. The main lines of the creeping stolon usually follow with much regularity the transverse sutures of the shell, the intervening spaces being barred by the cross fibres previously to the consolidation of the crust.

[Norway: Naples, in 10–20 fathoms, on shells tenanted by the *Pagurus* (Sars).]

2. *P. AREOLATA*, Alder.

HYDRACTINIA AREOLATA, Alder, Suppl. to Northumb. Cat. Trans. Tynes. Nat. F. C. v. 225, pl. ix. figs. 1–4.

RHIZOCLINE AREOLATA, Allman, Ann. N. H. for May 1864.

Plate VI. fig. 1.

POLYPITES *small, white, columnar*, slightly enlarging above, and terminating in a conical mouth; *tentacles* 6–10,

appearing of different lengths from their varying contractility; the incrusting base from which the polypites rise, a solid chitinous expansion, bearing simple linear spines in groups, having areolar spaces between them; GONOPHORES sessile on the base, large, globular, or slightly pear-shaped, containing each a single zooid.*

(GONOOID.—UMBRELLA (at the time of liberation) subglobose, moderately deep, covered with thread-cells; MANUBRIUM rather long and columnar, but not extending beyond the margin of the umbrella; RADIATING CANALS golden-yellow, continued by four rather short marginal tentacles with bulbous bases, one to three shorter tentacles in each interradial space, the number varying with age.

Height of polypite about $\frac{1}{10}$ inch.

PROF. ALLMAN has constituted for this species the genus *Rhizocline*, which he ranks amongst the *Hydractiniidæ*. From this decision I am compelled to dissent. The *H. areolata* of Alder is a true *Podocoryne*, presenting all the essential characters of that genus as defined by its founder, Sars.

The mere fact of its producing its gonophores on the stolon instead of the body of the polypite cannot entitle it to generic rank, for we meet with the same variation within the limits of a species. Nor is there anything peculiar in the nature of the incrusting base. Mr. Alder describes it as a "solid chitinous expansion;" but in its origin it is no doubt a reticulated stolon, the meshes of which are gradually filled in with chitine, as is the case in *Podocoryne carnea*†. The gonozoid of *H. areolata* agrees with that of *Podocoryne* in all essential particulars. In Mr. Alder's specimens the number of tentacles was 16;

* In an early stage this is probably represented by an open network.*

† Mr. Alder agrees with me in my interpretation of this portion of the structure.

but Mr. Hodge, who has obtained the species at Seaham Harbour, figures only 8, the largest number hitherto observed on *P. carnea*. In both cases there is a progressive increase with age, and as yet we do not know the maximum with certainty.

I have therefore no hesitation in referring Mr. Alder's Hydroid to the genus *Podocoryne*.

Hab. "On a dead shell of *Natica Alderi*, brought in by the fishing-boats at Cullercoats" (J. A.): on *Natica Grænlandica*, Shetland (A. M. N.): Seaham Harbour, in 30 fathoms (Mr. Hodge).

Genus CORYNOPSIS, *Allman*.

Der. From *κορύνη*, a club, and *ὄψις*, face (resemblance).

GENERIC CHARACTER.—*Polypites sessile, claviform, with a single verticil of filiform tentacula surrounding the base of a conical proboscis, rising from a creeping and ramified stolon, clothed with a chitinous polypary; gonophores borne on the body of the polypite below the base of the tentacles, and originating free, medusiform zooids.*

Umbrella of the gonozooid (at the time of liberation) deep bell-shaped; manubrium not reaching the orifice of the bell, with 4 short tentacles round the mouth; radiating canals 4, each terminating in a bulb, bearing two tentacles with a distinct ocellus at the base.

C. ALDERI, Hodge.

PODOCORYNE ALDERI, *Hodge*, Trans. Tynes. Nat. F. C. v. 82, pl. ii. figs. 10-15.

CORYNOPSIS ALDERI, *Allman*, Ann. N. H. for May 1864.

Plate VI. fig. 2.

POLYPITES tall and slender, tapering towards the base, of a pale pink colour, with 6 or 8 to 12 tentacles; GONOPHORES produced at a short distance below the tentacular verticil.

GONOOOID.—UMBRELLA (at the time of liberation) rather deeply campanulate; MANUBRIUM short, of a pale green colour; RADIATING CANALS terminating in conspicuous orange bulbs, each bearing two granulated tentacles, with a deep-red ocellus at the base.

Height of the polypites $\frac{1}{4}$ to $\frac{1}{2}$ inch.

THE polypite of this species presents all the characters of *Podocoryne*. The reproductive zooid is identical at the time of detachment with that of the genus *Bougainvillia*, which ranks amongst the *Eudendriidæ*.

It is probable that it follows the same course of development, and exhibits, when mature, the branched oral appendages and the marginal clusters of tentacles that belong to the latter in its adult state. But the later stages of its growth have not been observed.

Hab. Deep water, Seaham Harbour, Durham, on *Serpula* (G. H.).

Family IV.—Laridæ.

POLYPITES with a very small number of filiform tentacula, springing from the base of the proboscis, but not forming a circle round it.

Fig. 2.



Genus LAR, Gosse.

Der. *Lar*, a household god.

GENERIC CHARACTER.—*Polypites fusiform, sessile, with two tentacula springing from the base of a bilabiate proboscis, developed on a creeping and anastomosing filiform stolon**; reproduction unknown.

WE require further information before anything can be said with certainty of this extraordinary form. It has only occurred in Mr. Gosse's aquarium, and its reproductive phase has not been observed.

LAR SABELLARUM, Gosse.

Transactions of the Linn. Soc. xxii. 113, tab. xx.

Woodcut, fig. 2.

POLYPITES about $\frac{1}{40}$ inch in height, very slender towards the base, enlarging above and terminating in a head-like lobe, which is separated by a constriction from the rest of the body; mouth furnished with two prominent lips; tentacula long and muricated; the ADHERENT BASE a loose network of slender threads.

Mr. Gosse describes the polypites as bearing "a most ludicrously close resemblance to the human figure, and as closely imitating certain human motions." They were "incessantly bowing and tossing about their arms in the most energetic manner." Certainly if the figure from which our woodcut is copied be not exaggerated, a Larite colony must strikingly resemble a company of excited gymnasts.

* This adherent base is probably enclosed in a delicate polypary; but there is no mention of it in Gosse's description.

Allman says of the genus, "we are almost tempted to regard it as an abnormal condition of some other form." It must hold a provisional place until some new light is thrown upon its history by further observation.

Hab. On a *Sabella* in Mr. Gosse's aquarium.

Family V.—Corynidæ.

POLYPITES *with capitate tentacula, scattered or in several whorls.*

Genus CORYNE, Gaertner.

Der. κορύνη, a club.

CAPSULARIA, Cuvier, Tableau élémentaire, 665.

STIPULA, Sars, Bidrag til Södyrenes Naturhist. (1829).

SYNCORYNA, Ehrenberg, Corall. 70 (in part).

HERMIA, Johnston, Brit. Zooph. (1st ed.) 111.

ACROCHORDIUM, Meyen, Nov. Act. Acad. Nat. Cur. 1834, xvi. 165, tab. xxviii. fig. 8.

GENERIC CHARACTER.—*Stem simple or branched, rooted by a creeping filiform stolon, the whole sheathed in a thin chitinous tube, smooth or annulated; polypites terminal, clavate; tentacles capitate, scattered over the body or in several whorls; reproduction by means of fixed sporosacs, borne on the body of the polypite.*

AMONGST the polypites which answer to Gaertner's description, two or three very distinct modes of reproduction are met with, and it is therefore necessary to distribute them into corresponding groups. His name is here employed in a restricted sense, to designate the species that do not originate free medusiform zooids. The differences

between the present genus and *Syncoryne* are confined to the gonozooids, the polypites of both presenting the same characters. The list of synonyms must be understood to apply to the two genera.

The *Capsularia* of Cuvier is probably identical with *Coryne* as originally defined; but his description is defective and obscure, and his name has not been adopted by subsequent authors. I therefore retain Gaertner's well-established designation, though it is of later date.

There is still some uncertainty in the use of the name by authors. Even so high an authority as Van Beneden in his recent work follows Ehrenberg in making the *Hydra squamata* the type of the genus *Coryne*. But this is quite inadmissible, because (1) Gmelin had previously founded his genus *Clava* for this form; and (2) Gaertner, who originated the name *Coryne*, applies it to a polypite with capitate tentacles.

There is great difficulty in determining the synonymy of the species of *Coryne*. I believe it to be quite impossible to settle with any approach to certainty what the *C. pusilla* of Gaertner was. The name has been applied to many different forms, has almost been used as a general appellation for everything corynoid, and it is a serious question whether it would not be wise to discard it altogether. As, however, it is old and familiar and finds a place in every work on zoophytology, I have retained it, and have connected it with a species that perhaps agrees better than most with Gaertner's description and figure. It is of the first importance that there should be fixity of usage with respect to nomenclature, and I therefore hope that this decision may be accepted as a starting-point for the future.

We know but little of the geographical distribution of this and the following genus. Two or three species have

been observed in North America, one of which at least is identical with a British form*. A single species from the Pacific shores of the American continent (San Francisco) has been published by A. Agassiz; and I have met with a minute species on gulf-weed, which I believe to be undescribed. The genera are represented on the coasts of Greenland, of Norway (to the North Cape), of Sweden, and of Belgium by forms that occur in our own seas.

1. *C. pusilla*, Gaertner.

CORYNE PUSILLA, *Gaertner*, in *Pall. Spicil. Zool.* fasc. x. 40, tab. 4. fig. 8.

? SYNCORYNA LISTERII, *Van Beneden*, *Mém. sur les Tubul.* 54, pl. iii. figs. 11, 12.

CORYNA GLANDULOSA, *Dalyell*, *Rem. An. Scotl.* ii. pl. xxi.

CORYNE RAMOSA, *Alder*, *North. & Durh. Cat.* in *Trans. Tynes.* F. C. iii. 102.

„ SESSILIS (young), *Gosse*, *Devonsh. Coast*, 208, pl. xiv. figs. 1-3.

Plate VII. fig. 1.

STEM rather stout, irregularly and sparingly branched; polypary of a dark horn-colour, *closely and distinctly annulated throughout*; POLYPITE *long, linear, very slender, scarcely tapering towards the lower extremity*, reddish; *tentacles very numerous (30 or more), rather long and slender, and not expanded at the base, subverticillate*; GONOPHORES scattered over the body.

Height about an inch.

THE tentacles in *C. pusilla* are more truly whorled than in any other species of *Coryne*, but the arrangement is by no means perfectly regular. They are slender and furnished with large capitula.

The annulation of the stem is well-defined. The rings are narrow, closely set, and not prominent. The branch-

* The *Syndictyon* of A. Agassiz (*North-Amer. Aculephæ*, 177) is founded on a small Corynoid, obtained in Massachusetts Bay and Boston Harbour. The differences between it and *Syncoryne* are confined to the sexual zooid, and do not seem to be of generic value.

ing is simple and scanty. The tufts are of somewhat spare and straggling habit, and have no tendency to bushiness.

The linear figure of the polypites is a very marked character. They are slender, of considerable length, and of about equal size from one extremity to the other.

In some specimens I have noticed that the gonophores are slightly pointed above, and I believe that this peculiarity will be found to distinguish the male.

Sir John Dalyell's figure of *Coryna glandulosa* (Rem. An. vol. ii. pl. xxi.) is an admirable representation of this species. The *C. sessilis* (Gosse) is probably the young of it. At Ilfracombe (Mr. Gosse's locality) I have frequently found an unbranched and subsessile *Coryne*, agreeing very closely with his figure, which was undistinguishable from the *C. pusilla* that was growing in the same pools.

It is impossible to make much of the synonymy. The *C. ramosa* of Alder's Catalogue I know, from correspondence with the author, to be identical with *C. pusilla*. Possibly so is the *Stipula ramosa* of Sars. Alder has identified the *Syncoryna Listerii* (Van Ben.) with the present form, after the examination of specimens supplied by Van Beneden himself. If this decision be correct the figure in the 'Mém. sur les Tubulaires' is very inadequate. In his later work Van Beneden has assigned the name to a different form, which seems to be the *Syncoryne Sarsii*.

It were a hopeless task to attempt to clear up the confusion that has been caused by the want of sufficiently minute and careful diagnosis.

Hab. Scotland (Sir J. G. Dalyell): in rock-pools, Tyne-mouth (R. Howse): Filey, Yorkshire: Ilfracombe, in rock-pools (T. H.)

2. C. VAGINATA, Hincks.

CORYNE, *Lister*, Phil. Trans. for 1834, 376, pl. x. fig. 3.

„ RAMOSA, *Johnston*, B. Z. 42, pl. vi. figs. 4, 5; *Gosse*, Devon. Coast, 190, pl. ix.

? HERMIA GLANDULOSA, *Hassall*, Ann. N. H. for 1841, 283, pl. vi. fig. 2.

CORYNE VAGINATA, *Hincks*, Devon Cat. Ann. N. H. (ser. 3) ix. pl. vii. figs. 1, 1 a.

Plate VIII. fig. 1.

STEM *tall*, branched, annulated throughout; branches given off on all sides of the stem, bearing polypiferous ramuli; POLYPITES *fusiform*, *prolonged below into a slender neck, which is invested by a delicate membranous cup-like extension of the polypary*, ringed like the stem; *tentacles 15–20, or more, rather long and slender, bent inwards when at rest, extremities rose-coloured.*

GONOPHORES spherical, shortly stalked, produced in large numbers over the greater part of the body.

Height 3 or 4 inches in finely grown specimens.

THIS is one of several species that have been confounded under the name of *C. ramosa*. It is of tall and slender habit, and somewhat irregularly branched. The polypary is of firm texture and a decided horn-colour. The polypites are slender and fusiform, tapering off towards the mouth and downwards, and prolonged below into a narrow neck of some length. The upper extremity of the body is opake white, and the central portion of a reddish-brown colour. The tentacles are commonly held curved inwards, and have large, more or less deeply tinted roseate tips. The portion of the polypary surrounding the slender base of the polypite expands into a kind of cup, which extends nearly to the lowest tentacles. It is composed of three or four indistinct rings, and is simply membranous.

The stem and branches are closely and regularly annulated throughout.

The capsules present no peculiarity; they form a very

dense mass over about two-thirds of the body of the polypite. The ova are large, and have a conspicuous germinal vesicle. Mr. Gosse witnessed the exclusion of 25 from a single capsule, "the process being all over in about a minute." The number varies considerably: I have met with 12, 18, and 20. They are oval or circular, and of a brownish colour, but undergo remarkable changes of form after exclusion, shooting out processes here and there, and hardly presenting the same shape for many seconds together. They seem to have no locomotive power*.

This beautiful species is identical with the *Coryne* figured by Lister in his notable paper in the Philosophical Transactions for 1834. Gosse has also given a very characteristic representation of it. The *Syncoryna Listerii* of Van Beneden is certainly not identical with Lister's species.

Hab. In tide-pools, near low-water mark: South Devon: Ilfracombe, and neighbouring coast: Swanage, Dorset: Clew Bay, co. Galway (T.H.): co. Cork, common (G. J.A.): Channel Islands, very fine.

This is the common *Coryne* along the south-western coast. Its favourite habitat is amongst the luxuriant vegetation clothing the sides of the tide-pools, where it attains a large size, and adds not a little to the beauty of their scenery.

3. *C. VERMICULARIS*, Hincks.

"On New British Hydroids," Ann. N. H. for October 1866.

Plate VIII. fig. 2.

ZOOPHYTE *forming dense shrubby tufts*; STEM *much branched*

* Mr. Gosse has recorded similar observations in his 'Devonshire Coast,' pp. 194-195.

dichotomously, of a very light straw-colour and delicate texture, wavy, annulated, especially towards the base, the branches and upper portions of the stem often smooth or slightly wrinkled; POLYPITES of great length (about $\frac{1}{6}$ inch when mature), stout, almost cylindrical for half their length when extended, then tapering off very gradually towards the oral extremity; tentacles in irregular and very distant whorls, rather stout, with large capitula, about 25 in number.

GONOPHORES borne at the base of the tentacles over the lower half of the body, spherical, shortly stalked.

Height of the tufts about $\frac{3}{4}$ inch.

THE size of the polypites is the point that first attracts attention in this species. The length is remarkable, being about a third greater than in any other British *Coryne*. The body is thick, and cylindrical below, and tapers off very gradually towards the apex. Altogether the polypites have a very worm-like appearance. The tentacles are sparingly distributed over the surface, a considerable space intervening between the imperfect whorls over the whole of the upper portion of the body. They are more numerous and closely set near the base.

The polypary is exceedingly delicate, being colourless and perfectly transparent on the branches, where the ringings are often very faint or obsolete. The coenosare is of great thickness, almost filling up the tubular cavity of the stem. The branches are short and wavy. The ramification commences near the base of the primary stem, and consists of a succession of dichotomous divisions and subdivisions, resulting in the formation of little shrub-like tufts. Many filamentous branchlets, not bearing polypites and slightly clavate at the extremity, are distributed over the zoophyte (Plate VIII. fig. 2, *x x*). The reproductive buds seem to be confined to about the lower third of the body.

In many of the polypites the anterior portion of the body is much swollen and destitute of tentacles, a change which is probably due to the presence of some parasitic larva. [Woodcut, fig. 3.]

I have not had the opportunity of examining *C. vermicularis* in a living state. The foregoing description is founded on numerous specimens, well preserved in spirit, which were supplied by Mr. Busk.

Hab. Shetland, from deep water.

Fig. 3.



4. *C. FRUTICOSA*, Hincks.

"Catalogue of Devon and Cornwall Zoophytes," Ann. N. II. (3rd ser.) viii. 158-9, pl. vi. figs. 5, 6.

Plate VII. fig. 2.

ZOOPHYTE *bushy*; STEM *slender, slightly and irregularly annulated throughout, much branched*; polypary *delicate and light-coloured*; BRANCHES *erect, long, closely set, much and irregularly ramified*; POLYPITES *somewhat swollen below, tapering above, with about 20 tentacula, which are rather long and furnished with small capitula, a verticil of five immediately below the mouth, and the rest scattered.*

GONOPHORES *densely clustered, chiefly about the lower part of the body, sessile.*

Height from an inch to an inch and a half.

THIS species forms dense, clustered, bushy masses on *Fucus*; it is of very delicate habit. The polypary, which is extremely thin and transparent, is more or less ringed throughout, but the annulations are neither regular nor strongly marked. The branches grow erect, and attain a

considerable length, those which spring from the lower part of the stem often rising to the height of the main shoot; they are set closely together, and give off plentifully secondary branches and branchlets. The polypites are of moderate size; they are somewhat enlarged below, and taper gradually towards the oral extremity. They want the narrow neck that supports those of *C. vaginata*, and there is no membranous eup at the base. The tentacles are rather long and slender, and have very small tips. The reproductive sacs, when mature, are very large; they often form a kind of collar round the lower part of the body, but are sometimes more diffused. The dense bushy growth of *C. fruticosa* is very unlike that of any other British species.

Hab. On *Fucus*, Mount's Bay: Exmouth (T. H.): Herm (half-tide), forming luxuriant tufts on a seaweed (G. Hodge).

5. *C. VANBENEDENII*.

SYNCORYNA PUSILLA, *Van Beneden*, Rech. sur les Tubul. 52, pl. iii. figs. 1-10.
CORYNE PUSILLA, *Johnst. B. Z.* 41, pl. iv. figs. 1, 2.

Plate IX. fig. 1.

ZOOPHYTE *small and very delicate*; STEM *flexuous, irregularly branched, bearing many short, non-polypiferous ramules*; *polypary transparent, papyraceous, pale yellow, with a few obscure wrinkles*; POLYPITES *small, subclavate, with a slight membranous cup round the base*; tentacles from 12-16, or sometimes more; GONOPHORES few in number (2-3), very large, pedunculate, situated at the base of the lower tentacles; EMBRYO *actiniform*.

Height from $\frac{1}{2}$ to $\frac{3}{4}$ inch.

WE are mainly indebted to Van Beneden for our know-

ledge of this species, which he has described under the name of *Syncoryna pusilla*. It has no claim, however, to be identified with the original *C. pusilla* of Gaertner, and I have therefore renamed it after its distinguished discoverer.

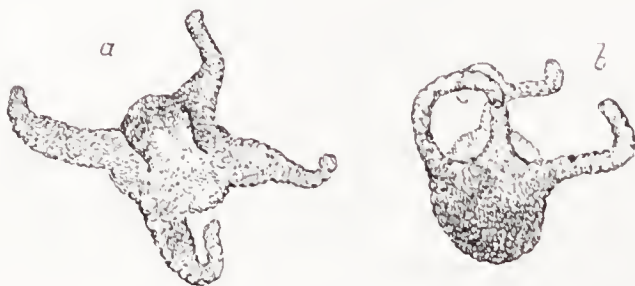
Van Beneden describes the tentacles as disposed in three equidistant rows of four each, but remarks that he had seen individuals with only two rows, and that in other cases it was difficult to recognize any regularity in their disposition. The number of arms is dependent on age, and in adult polypites reaches 16 or even more. There is a very slight tendency to verticillate arrangement.

The stems are extremely delicate and irregularly flexuous, and the polypary is thin and transparent. The number of short ramuli not bearing polypites is a marked character.

The polypites are somewhat clavate in form, blunt, and rounded at the oral extremity, and tapering off slightly below, but not produced as in *Syncoryne Sarsii*. There is a small membranous dilatation of the polypary round their base.

Van Beneden has given us an account of the mode of reproduction. The embryo is actiniform, and on issuing from the reproductive sac resembles a miniature *Octopus*,

Fig. 4.



with four arms (fig. 4). It moves slowly about for a

time by means of its rudimentary tentacles, and at last fixes itself by the base and assumes the perfect form.

Through the kindness of the late Mr. Alder I have had the opportunity of examining specimens supplied by Van Beneden himself, and found at Ostend, and I am thus enabled to describe some of the earlier stages of development.

The gonosae are capacious and contain a single embryo, which occupies the centre of the cavity.

The oral extremity is uppermost; and four rudimentary tentacles can be distinguished through the walls of the sae, in mature specimens, surrounding a prominent proboscis. Four simple tubular processes, taking their origin in opposite pairs at the base of the gonosae, embrace the embryo, and converge above it (Plate IX. fig. 1 c). They are the representatives of the gastrovascular canals.

We have in this case a mode of reproduction very similar to that which is met with in the genus *Tubularia*.

I am unable to give any British habitat for *C. Van-Benedenii*. It has never occurred to myself, nor have I received it from any of my correspondents. Dr. Johnston, however, has given an original and very characteristic figure of it, which was taken from British examples, and he states that it is often parasitical on *Tubularia indivisa*.

The *Syncoryna pusilla* of Van Beneden's latest work* is a different species, and referable to the next genus.

* Recherches sur la Faune Littorale de Belgique, *Polypes*, 1866. p. 119.

Genus SYNCORYNE, *Ehrenberg* (in part).

Der. σὺν, along with, and *Coryne*, a genus of Hydroids.

[The synonymy given for the last genus applies equally to this.]

SARSIA (the free zooid), Lesson, Zooph. Acaleph. 333.

STHENYO (ditto), Dujardin, Ann. Sc. Nat. (1845).

SYNCORYNE, Allman, Ann. N. II. for May 1864.

GENERIC CHARACTER.—*Stem simple or branched, rooted by a creeping filiform stolon, the whole sheathed in a thin chitinous tube, smooth or annulated; polypites terminal, more or less clavate; tentacles capitate, scattered over the body; gonophores borne on the body of the polypite, and containing medusiform zooids.*

Gonozooid: Umbrella (at the time of liberation) deep bell-shaped or globular; manubrium not reaching to the orifice of the bell, with a simple mouth; radiating canals 4; marginal tentacles 4, springing from ocellated bulbs. The mature zooid has the manubrium enormously developed.

SYNCORYNE embraces the members of the old genus *Coryne* that originate free reproductive zooids of the *Sarsia* type. I follow Allman in adopting for this section Ehrenberg's name, which has been widely used, especially amongst continental naturalists.

There are several points of special interest in the reproductive history of this genus. In the first place, the free zooids of the British species are either identical, or nearly so, at the time of their liberation from the parent stock. The differences, where any exist, are very slight. In one case (*S. gravata*) the umbrella is destitute of thread-cells, which are present in all (?) the other species. *S. pulchella* has two interradial furrows on the bell, and *S. gravata* and *S. decipiens* four. In *S. eximia*

and *S. Sarsii* no furrows have been observed. The gonozoids of these two species, and of the *Stauridium productum*, seem to be perfectly similar in all external characters, at least in the first period of their free existence. Observations are still wanting to show whether differences arise in the further course of their development.

The researches of Agassiz have proved that the free zooid of *S. gravata* (*C. mirabilis*, Agass.) assumes, when mature, the form of *Sarsia*, a genus founded by Lesson for a "Naked-eyed Medusa," whose most striking characteristic is the remarkable length and extensibility of the manubrium. It was discovered by the distinguished Norwegian naturalist whose name it bears.

The changes which the zooid of *S. gravata* undergoes in its progress towards maturity seem to be almost confined to the manubrium. There is a slight alteration in the shape of the umbrella, but no increase in the number of tentacles with age. The manubrium in the adult state, when extended, is twice or three times the length of the umbrella. The upper portion, by which it is suspended from the centre of the crystal dome, is thinner than the rest; the middle region is somewhat inflated (and it is here that the ova are developed), whilst towards the free extremity it is more or less clavate in form [Plate III. fig. 3]. At the time of liberation, the manubrium is of moderate dimensions, and does not extend to the mouth of the bell. It is probable that in all the species of *Syncoryne* the free zooid passes through a similar change.

We are also indebted to Agassiz for the interesting observation that the gonozooid in some cases presents a very different appearance in the early and latter part of the breeding-season. In the one it is free and perfectly developed; in the other it is sometimes reduced to a fixed

condition, its shape is altered, the tentacles are wanting, and the generative products are matured while it is attached to the zoophyte. In such cases the polypites also are often atrophied. One or two species have been founded on this merely seasonal phase.

The species of *Syncoryne* are for the most part littoral, and seem to be very indifferent to the quality of the water in which they live. *S. gravata*, according to Agassiz, is found either in pure sea-water or at the mouths of rivers; and Lovén states that *S. Sarsii* occurs even in stagnant water.

1. *S. EXIMIA*, Allman.

CORYNE EXIMIA, *Allman*, Ann. N. H. for August 1859.

„ LISTERII, *Alder*, North. Cat. in Trans. Tynes. Club, iii. 102.

SYNCORYNE EXIMIA, *Allman*, Ann. N. H. for May 1864.

Plate IX. fig. 2.

ZOOPHYTE forming large entangled masses, much and irregularly branched; MAIN STEMS *smooth, except towards the base*; BRANCHES *generally ringed above their origin, bearing polypiferous ramuli, which are mostly unilateral and annulated throughout*; POLYPITES rather small, with a membranous cup round the base; tentacles from 20 to 30, scattered over the body, with the exception of the first 4, which are disposed in a verticil behind the mouth; GONOPHORES *pedunculate, springing from the bases of the tentacles over the greater part of the body*.

UMBRELLA of the free zooid (at the time of liberation) deeply bell-shaped, studded with thread-cells of large size (about 0.06" in transverse and a little more in vertical diameter), with a wide velum; MANUBRIUM reddish, extending to about the middle of the umbrella; MARGINAL TENTACLES very extensile, springing from large

red bulbs, with a dark reddish-brown ocellus on the outer side, and set with knot-like clusters of thread-cells, the terminal group forming a spherical bulb. Height of the stems 3 or 4 inches in fine examples.

S. EXIMIA has small reddish polypites, with an opaque-white proboscis, and a very delicate membranous cup round the base.

The general colour of the zoophyte is a pale pink. The reproductive buds are mounted on long peduncles, and are developed in large numbers over almost the whole of the body.

The smoothness of the principal stems and the unilateral arrangement of the branchlets are characteristic points.

S. eximia is one of the Hydroids that are infested by the larvæ of the *Pycnogon*, a very curious form of Crustacean*. The parasitism is of a most extraordinary kind. At a very early stage of their existence the young *Pycnogons* gain access in some way or other to the interior of the Zoophyte, and find their way through the cavity of the cœnosarc into the budding polypites, which they occupy, using them as nests during the further stages of their development.

The growth of the nascent polypites thus invaded is arrested, and they are converted into long clavate sacs, within which the larval intruders find an undisturbed retreat. At the proper time they rupture the investing polypary, and make their exit.

On a small colony of the *Syncoryne* I have found as many as five of the *Pycnogon* sacs. They were of a rose-red colour; and from one of them the young Crustacean was extricating itself, one or two legs protruding at the top.

* *Vide* a paper by Mr. Geo. Hodge, Ann. N. H. (ser. 3) vol. ix. p. 33.

Hab. Attached to rocks and the stems of *Laminaria digitata*, Firth of Forth (G. J. A.) : on *Corallina* and other seaweeds, and on the sides of rock-pools, Northumberland, very abundant (J. A.) : Seaham Harbour, abundant (G. Hodge) : Hartlepool (A. M. N.) : Whitby : Filey Brigg, on *Laminaria* and other weeds, towards low-water mark, very abundant (T. H.).

This is the common *Syncoryne* along the north-eastern coast.

2. S. Sarsii, Lovén.

- SYNCORYNA Sarsii, Lovén, Svenske Vetensk. Acad. Handl. 1835, tab. viii. figs. 7-10; Wiegmann's Archiv, 1837, 321, tab. vi. figs. 25-28; Sars, Faun. Litt. Norv. part i. 2, t. i. figs. 1-6.
 „ RAMOSA, Lovén, loc. cit. tab. viii. figs. 1-6.
 „ LOVENII, Sars, Faun. Litt. Norv. part i. 2 (footnote).

Plate VII. fig. 3.

STEM slender, very sparingly branched; polypary transparent, of a very light horn-colour, slightly and irregularly wrinkled or annulated, especially towards the base, generally smooth above; POLYPITES elongate oval, of a light red colour, produced below into a long neck, with 12-16 tentacles scattered over the body; GONOPHORES (2 or 3) with short peduncles, borne chiefly, but not exclusively, at the base of the lowest tentacles.

UMBRELLA of the free zooid (at the time of detachment) globular, with thread-cells; MANUBRIUM short; MARGINAL TENTACLES springing from bulbs, each bearing a reddish-brown ocellus, nodulated with thread-cells, and terminating in a spherical cluster.

Height of zoophyte about $\frac{1}{2}$ inch.

THE stems of *S. Sarsii*, which are very slender, and not flexuous and tangled as in *Coryne VanBenedenii*, are either simple or bear two or three short branches. There is very

little *distinct* annulation on the polypary, but towards the base there is always a certain amount of rather irregular ringing, and here and there it is more or less strongly wrinkled. The upper part is generally smooth. The polypite is ovate above, and produced below. The polypary only extends to the base of a long neck, on which the tentaculiferous portion of the body is supported. The line of junction is very distinctly marked.

The erect and comparatively simple habit, the annulated stem, and the form of the polypite distinguish this species from the *C. VanBenedenii*. It is also of larger size.

As Agassiz has suggested, the *Syncoryna ramosa* (Lovén) (*S. Lovénii*, Sars*) is probably only the phase assumed by the *S. Sarsii* towards the close of the breeding-season.

Hab. Firth of Forth (T. S. W.): Seaham Harbour, Durham, on *Antennularia*, from 25 to 30 fath. (G. Hodge).

[The Cattegat (Lovén): Island of Floröc (Sars).]

3. *S. GRAVATA*, T. S. Wright.

CORYNE GRAVATA, *Wright*, Observat. on Br. Zooph. Ed. New Phil. Journ. for April 1858, pl. vii. fig. 5.

SARSIA MIRABILIS (the sexual zooid), *Agassiz*, Mem. Amer. Acad. of Arts and Sciences (1860), iv. part ii. 224, pl. 4. 5.

CORYNE MIRABILIS, *Agassiz*, N. H. U. S. iv. 185, pl. xvii. (vol. iii.).

TUBULARIA STELLIFERA, *Couth.* Boston Journ. N. H. ii. 56.

Plate X. fig. 1.

STEM *smooth*, simple or slightly branched; POLYPITES *small, slender, with 16 tentacles* in the adult state;

* The *Syncoryna Lovénii* of Van Beneden (Rech. sur la Faune Litt. de Belgique, p. 121, pl. v. figs. 6, 7) is a totally distinct species; its polypites are of great length, and have many whorls of tentacles. It may be our *Coryne pusilla*, but I confess myself unable to identify with certainty any of the species of *Syncoryne* described in the above work.

GONOPHORES somewhat globular, borne amongst the tentacles, or immediately below them.

GONOOZOID.—UMBRELLA (at the time of liberation) globular, *destitute of thread-cells, with 4 interradial furrows*; MANUBRIUM extending to about the middle of the umbrella, subcylindrical; MARGINAL TENTACLES springing from bulbous bases, bearing a prominent dark ocellus, nodulated with clusters of thread-cells, and terminating in a spherule.

THIS species is the subject of an elaborate memoir by Agassiz, in which he has treated its history exhaustively. He has also fully described the adult gonozoid in a separate paper. Wright had previously discovered the species in Scotland, but had only met with it in the depauperated condition which, according to Agassiz's observations, it assumes towards the close of the breeding-season. He describes his *Coryne mirabilis* as producing in the early part of the year free gonozoids that resemble the *Sarsia* of authors, while later on (April or May) these disappear, and their place is taken by medusiform bodies of a different shape, which probably in most cases continue fixed, and mature their generative elements *in situ*. And this change in the reproductive zooid is usually accompanied by the degeneration and sometimes total disappearance of the polypites. In this stage of the life-history, the gonozoids are imperfectly developed. They are elongate-ovate or cylindrical in form, generally with four small bulbs instead of tentacles, and a manubrium inflated by the mass of ova or spermatozoa, so as almost to fill the cavity of the bell. Occasionally the tentacles are developed, but "they have a stiff, jagged, and awkward appearance." Some of these abnormal zooids have "a withered and wrinkled look," and probably cast their products *in situ* and then perish. Others exhibit vigorous movements, and

may, Agassiz conjectures, drop from the parent stem, though he has never found them swimming freely like the perfect zooid. At the same time the polypites are often more or less affected. The tentacles are sometimes reduced by absorption to mere papillæ; sometimes they disappear altogether; and in some cases the whole head vanishes, and the stem is surmounted by a single gonozooid, or occasionally by two.

In the month of May I found a large colony in the latter condition, overspreading the underside of a stone on Filey Brigg. The heads of the polypites had in almost all cases disappeared, and each stalk bore near its extremity one or two ovate medusiform bodies attached by a short peduncle (Plate X. fig. 1 *d*). The tentacles were represented by mere projections on the margin of the umbrella, on each of which there was a dark spot. The manubrium was rose-coloured and not inflated. The zooids were active in their movements.

I have no doubt that the *C. gravata* of Wright is identical with the *C. mirabilis* of the American coasts; and his name, as the first published, must take precedence.

Agassiz has established the identity of the free zooids produced by his *Coryne mirabilis* with a *Sarsia* (of authors) which abounds in Boston Harbour during the spring months (March, April, and May). The ice has scarcely gone from the shores, we are told, when it makes its appearance in numbers, that "swarm near the surface on any sunny day"*. The adult zooid seems to resemble very closely the *Oceania* (*Sarsia*) *tubulosa* of Sars, figured in the 'Beskrivelser,' and may probably be identical with it. It is described as very active and graceful in its movements, and very voracious, swallowing quickly "large numbers of small Medusæ and, especially, other kinds of

* 'North American Acalephæ,' by Alexander Agassiz, 176.

Hydroid Medusæ and the young of *Aurelia flavidula*, and also other soft animals and small Crustacea." Forbes has celebrated the appetite of *Sarsia tubulosa* for Crustacean diet, and tells us how it apparently enjoys "the destruction of the unfortunate members of the upper classes with a truly democratic relish."

The manubrium is capable of extraordinary elongation, and is a formidable instrument for the capture of prey. When contracted, it is not more than half the length of the bell.

S. gravata is of humble size and very slightly branched. The stems are often perfectly simple, and only about a quarter of an inch in height. Dr. Wright describes the polypites as colourless; but Agassiz says that the zoophyte is tinted rose by coloured granules lining "the whole extent of the digestive cavity and chymiferous tube." Possibly the absence of distinct colour may have been due to the depauperated condition of the specimens examined by the former of these observers.

Hab. North Berwick, spreading over the surface of stones in a rock-pool (T. S. W.); Filey Brigg, Yorkshire, in a similar situation (T. H.). I have also taken the form known as *Sarsia tubulosa* at the same place.

[North America (Agassiz).]

4. *S. DECIPIENS*, Dujardin.

SYNCORYNA DECIPIENS, *Dujardin*, Ann. Sc. Nat. (3rd ser.) Zool. vol. iv. 275, pl. xiv.

Plate X. fig. 2.

STEM smooth, slightly branched; POLYPITES slender, reddish, somewhat fusiform, with a prominent proboscis and much produced below: tentacula 8 or 9, scattered over

the thickest portion of the body; GONOPHORES pyriform, reddish, on short peduncles, *borne behind the lowest tentacles.*

UMBRELLA of the free zooid bell-shaped, the height and width about equal, *with four interradial furrows**; MANUBRIUM lageniform; MARGINAL TENTACLES springing from bulbous bases, each with a dark ocellus, nodulated with thread-cells, and terminating in a larger spherical cluster.

THIS species is nearly related to the preceding. The small number of tentacles is one of the chief distinctive characters. The gonophores also, apparently, are not scattered amongst the tentacles as in *S. gravata*, but are borne behind the lowest.

I have not had the opportunity of examining specimens; but Mr. Alder's drawing from which our figure is taken, and which may be trusted for its accuracy, shows that the form of the polypite is peculiar. The oral extremity is elongated and narrowed; immediately below it the body swells out for a short distance, and then tapers off gradually towards the base. The tentacles, which are rather long and slender, are distributed over the thicker portion of the body.

The species requires further investigation.

Hab. Firth of Forth (T. S. W.).

5. *S. PULCHELLA*, Allman.

"Notes on the Hydroida," Annals N. H. for June 1865.

STEMS *unbranched* and attaining a height of about half an inch, *not annulated, but with a few shallow transverse corrugations towards the base, of an orange colour; POLY-*

* "Au milieu de l'intervalle des canaux se trouve un sillon qui paraît occupé par un cordon tendineux, duquel partent des fibres contractiles."—*Dujardin*.

PITES *with 15–20 tentacula, body deep orange, becoming pale where it passes into the stem; GONOPHORES borne on short peduncles in a dense cluster immediately behind the lowest tentacles.*

GONOOZOID.—UMBRELLA bell-shaped, with its transverse and vertical diameters nearly equal, *covered with thread-cells, and traversed by two opposite interradial furrows, extending from the base of the manubrium to the margin of the bell; MANUBRIUM deep orange; MARGINAL TENTACLES springing from orange bulbs, with a distinct ocellus, nodulated with clusters of thread-cells, and with a larger spherule at the extremity.*

CLOSELY allied to *S. decipiens*, from which it differs “in its simple habit, in the more ovate form of the polypite, and in its more numerous tentacles” (*Allman*). The umbrella also has only two of the furrows, instead of four as in Dujardin’s species.

Hab. Rooted to the bottom of rock-pools near low-water mark. Skelmorlie, Firth of Clyde (G. J. A.).

Genus ZANCLEA, *Gegenbaur* *.

GEMMARIA, M’Cradly, Gymnophthalmata of Charleston Harbour, Proc. Elliott Soc. Nat. Hist. Charleston, 151.

GENERIC CHARACTER.—*Stem simple or branched, rooted by a creeping filiform stolon, the whole invested by a chitinous polypary; polypites more or less clavate; tentacles capitate, scattered over the body; gonophores borne on the body of the polypite, and originating free medusiform zooids.*

Umbrella of the sexual zooid (at the time of liberation) nearly spherical; manubrium not reaching the margin of the bell, with a simple mouth; radiating canals 4; marginal

* “Versuch eines Systemes der Medusen,” in Zeitschrift für wissenschaftliche Zool. 1856, p. 229, t. viii. fig. 4.

tentacles 2, set along one side with pedunculated sacs, filled with thread-cells, and springing from non-ocellated bulbs at the extremities of opposite canals—the two intermediate canals terminating in bulbous dilatations, without tentacles; a cæcal tube filled with thread-cells extending, in the walls of the umbrella, from the bases of the 4 tentacular bulbs, and parallel to the corresponding radiating canal.*

ACCORDING to Gegenbaur's observations, the free zooid of *Zanclea* has *four* tentacles when adult. The *manubrium* does not change with age, as in that of *Syncoryne*, but continues short up to the time of the development of the ova†.

The characters on which the *Gemmaria* of M'Crady is founded seem to be quite insufficient to justify its separation from *Zanclea*, if unaccompanied by important differences in the trophosome. A. Agassiz believes that the polypites of the two forms are most closely allied; if so, I can see no ground for retaining M'Crady's genus.

Z. IMPLEXA, Alder.

TUBULARIA IMPLEXA, *Alder*, Trans. Tynes. Club, iii. 108, t. ix. figs. 3–6.

CORYNE PELAGICA, *Alder*, *ibid.* iii. 103, t. ix. figs. 1, 2 (the young).

„ IMPLEXA, *Alder*, *ibid.* v. 227.

„ BRIAREUS, *Allman*, Ann. N. H. (July 1859), 3rd ser. iv. 54.

ZANCLEA IMPLEXA, *Allman*, Ann. N. H. for May 1864.

Plate IX. fig. 3.

STEM slender, slightly and subunilaterally branched, from

* Of these groups of thread-cells M'Crady says (Gymnophthalmata of Charleston Harbour) that their "refractive power gives them a brilliancy such as to remind us irresistibly of clusters of precious stones. These brilliants are set in a membranous case."

† *Vide* Gegenbaur's figure, tab. viii. f. 4 i.

$\frac{1}{2}$ to $\frac{3}{4}$ inch high; POLYPARY composed of two coats, the inner horny, more or less annulated, the outer membranous, smooth, transparent; POLYPITES nearly cylindrical, much elongated, very transparent, of a pearly white colour; tentacles numerous (40–50), very small and slender, set in 7 or 8 imperfect rows; GONOPHORES in a single subverticillate cluster towards the lower part of the body, shortly stalked.

GONOOZOID with a nearly spherical UMBRELLA (at the time of liberation) and a wide velum; MANUBRIUM subeylindrical, earmine-coloured; MARGINAL TENTACLES springing from reddish tubercles.

THIS species is one of the most beautiful of its tribe, and is at once distinguished by the peculiar structure of its polypary, the long subeylindrieal body, and the very large number and remarkably small size of the tentacles. It sometimes forms dense tangled masses, but is not uncommonly found of much humbler size and simpler growth.

Dr. Wright has described the thread-cells, which are of two kinds—oval and barbed on the tentacles, and long and eylindrieal on the body of the polypite. Both are present within the polypary.

We have an interesting observation by Allman on the structure of the tentacles of the gonozoid*. He found the peduncles of the sacs containing thread-cells (which are set along the whole length of the arms) to be capable of enormous elongation. They have the power of extending themselves to a length which considerably surpasses that of the longer or vertieal diameter of the umbrella. “While the medusa continued to float undisturbed through the water, the peduncle would remain projected in a straight line, becoming at the same time amazingly attenuated; but on the least disturbance it would become

* “Notes on the Hydroida,” Ann. N. H. for July 1864.

suddenly shortened to less than the one-twentieth part of its length when extended, drawing the capsule back with it in its contraction.”

A pencil of long fine vibratile cilia surmounts each capsule, and keeps it, when the peduncle is extended, in a state of constant movement.

Hab. On an old anchor from 40 fathoms, 30 miles east of Holy Island, coast of Northumberland (R. Howse) : on shells of *Fusus antiquus* from deep water, Cullercoats (J. A.) : on *Cellepora pumicosa*, Seaham Harbour (G. Hodge) : Inch Garvie (T. S. W.) : on stone in a rock-pool, Firth of Forth (G. J. A.).

Family VI.—Stauridiidæ.

POLYPITES clavate or subcylindrical, with true and false tentacula, the former capitate, and disposed in one or more verticils ; the latter rigid, without capitula, and probably serving as tactile organs.

Genus CLADONEMA, Dujardin.

Der. κλάδος, a branch, and νῆμα, a thread (tentacle).

GENERIC CHARACTER.—*Stems simple or branched, rooted by a creeping filiform stolon, the whole invested by a polypary ; polypites borne on the summit of the stems and branches, clavate, with a single verticil of four capitate tentacula placed immediately below the oral extremity, and disposed in the form of a cross, and beneath these four false tentacles or tactile organs, also arranged in a cross,*

rigid, destitute of capitula, covered towards the extremity with palpocils; gonophores borne on the body of the polypite, and originating free medusiform zooids.

Gonozooid.—*Umbrella* deep bell-shaped; manubrium large, with a number of tubercles round the mouth; radiating canals 8–10; marginal tentacles springing from ocellated bulbs at the extremity of the canals, branched, nodulated with clusters of thread-cells, and furnished towards the base with appendages bearing suctorial disks.

ALLMAN ranks *Cladonema* and *Stauridium* in the family of the *Pennariidæ*; but their affinity, as it seems to me, is clearly with the *Corynidæ* and *Clavatellidæ*, while *Pennaria* is closely allied to *Tubularia*. The curious appendages which I have named *false tentacles* can hardly be compared with the wreath of inferior tentacles in the latter genus; they are members of the same system to which the capitate arms belong, modified, and discharging a different function.

C. RADIATUM, Dujardin.

CLADONEMA RADIATUM (free zooid), *Dujardin*, Ann. des Sc. Nat. xx. (1843) 370; Ann. des Sc. Nat. (3rd ser.) Zool. iv. 271.

CORYNE STAURIDIA ("the slender Coryne"), *Gosse*, Dev. Coast, 257, pl. xvi. figs. 1–5.

Plate XI.

STEM simple or slightly branched, of extreme tenuity; polypary perfectly hyaline and smooth; POLYPITES clavate, rounded at the oral extremity, tapering off below (when extended) to about the thickness of the stem, coarsely annulated; the endoderm laden with opaque-white granules; the four capitate tentacula covered with small tubercles, bearing palpocils; the four false

tentacles placed a little above the termination of the body and at right angles to it, rounded at the tip; GONOPHORES large, two or three in number, developed at the base of the inferior tentacles.

GONOOZOID.—UMBRELLA deep bell-shaped, covered with minute thread-cells, slightly produced and pointed at the top, immediately over the base of the manubrium; MANUBRIUM fusiform, lobed, with 5–7 oral tubercles; MARGINAL TENTACLES springing from red bulbs, each with a dark ocellus, more or less branched, very extensible, roughened by prominent groups of thread-cells, and furnished with a variable number (1–4) of filiform appendages, terminating in suckorial disks.

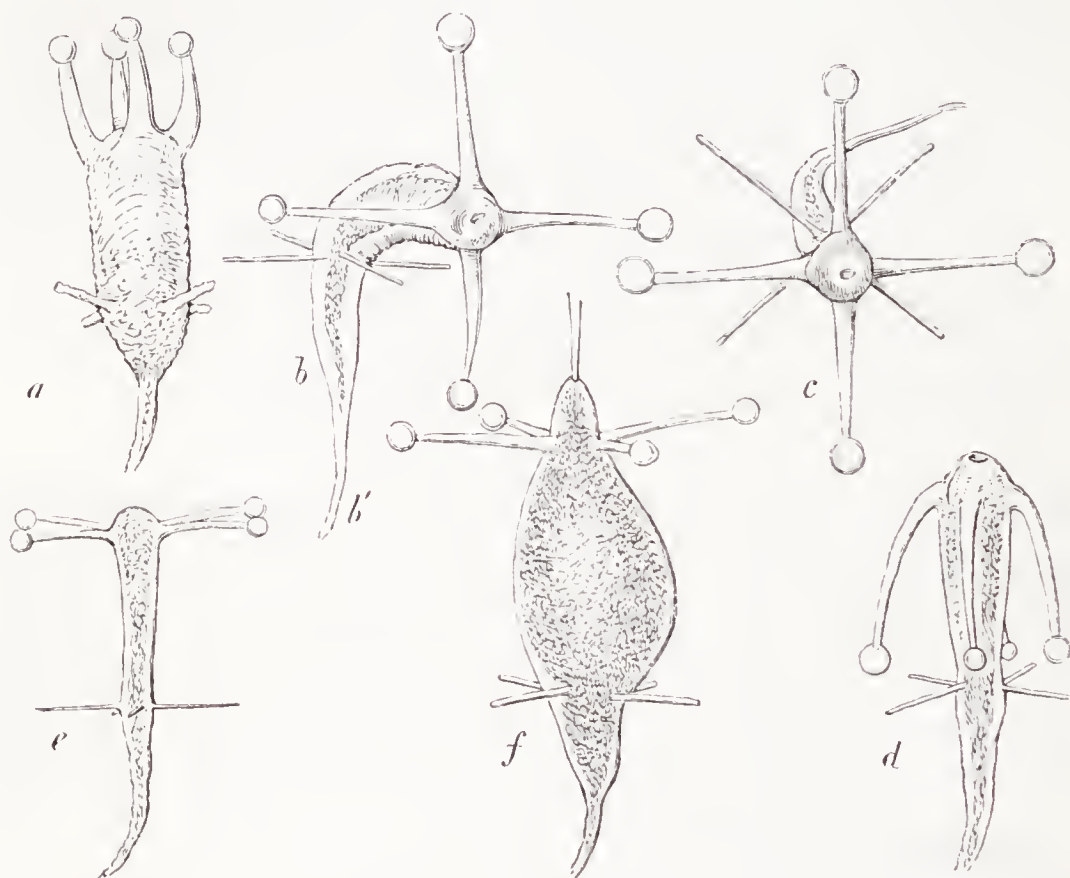
DUJARDIN was the first to describe this very curious and beautiful Hydroid. He has given a full account, accompanied by admirable figures, of its structure and development. It has also been studied by Krohn, Gegenbaur, and Van Beneden. Gosse has described the polypites from Devonshire specimens, but did not meet with the reproductive bodies.

My friend Mr. E. W. H. Holdsworth has been fortunate enough to procure several specimens of the free zooid from the tanks in the Zoological Gardens, and has succeeded in keeping them, so as to trace almost the entire course of the reproductive history, while his own aquarium has yielded the polypites in considerable numbers. His notes and sketches he has very kindly placed at my disposal; and they enable me to supply an original account of the species, which corroborates, and in one or two points corrects, that which we have from Dujardin.

The polypites are very mutable in form, as the accompanying woodcuts, which are careful studies from nature, will show (fig. 5). Fig. *f* represents an individual that has swallowed a *Cyclops*, whose tail protrudes from the mouth.

“All the motion,” Mr. Holdsworth remarks, “takes place above the lower arms, which always appear to retain

Fig. 5.



their position at right angles to the lower part of the body.” The apparatus for the capture of food is very complete. The spherical bulb at the extremity of the upper tentacles is a congeries of thread-cells, each of which furnishes its projectile; the arm itself is endowed with vigorous percussive power, and its surface is studded with minute tubercles surmounted by sensitive palpo-cils. The false tentacles are rounded at the tip, which is thickly covered with the tactile hairs; and their function seems to be to give notice of the presence of animalcules or other prey. If anything touches one of them, the head and upper arms are instantly bent towards it.

The specimens of the gonozoid examined by Mr. Holds-

worth differed from Dujardin's in having ten arms instead of eight, and seven oral lobes instead of five. The number of branches on the arms is variable. In some cases there is only one, in others two or three are present. Probably the number increases with age. The suetorial appendages also vary in number. "Most commonly there are three, rarely only one, more frequently two, and sometimes four." They are attached to the tentacles just above the basal enlargement, and, unlike the same organs in *Clavatella prolifera*, are never used for locomotion. The zooid frequently fixes itself firmly by means of its suckers, and the arms are thrown back ("redressés"), and stand erect around the umbrella*. It swims by short and rapid jerks; and when in motion, the tentacles are closely retracted and the suckers outstretched.

The lobes which surround the mouth are pedunculated clusters of thread-cells, and are identical in structure with the capitula of the tentacles.

The later stages in the history of the zooid have been carefully observed by Mr. Holdsworth; and his account of them agrees in the main with Dujardin's. After a time the umbrella begins to slough away at the top, and the subumbrella is much depressed, so that the manubrium is protruded through the orifice in the velum. At this stage the zooid is firmly attached by its suckers, and the arms are in frequent motion.

The sloughing away continues until there is nothing left but the manubrium "with the subumbrella flattened

* "Rien n'est gracieux comme un Cladonème nonchalamment étalé au milieu de son bassin, fuyant devant quelque danger imaginaire ou réel, ou solidement tapi par ses ventouses pour résister au courant, pendant qu'il étale soigneusement ses longs eirrhés dans toutes les directions. On peut rester des heures entières en contemplation devant ces organismes infimes, qui semblent moins solides qu'une bulle de savon, et qui se conservent cependant en dépit des vagues, des chocs et des tempêtes."—*Van Beneden*.

down and gathered together at its base, the tentacles being still perfect and forming a fringe at the rear of the base." They are as active in contraction and extension as when the umbrella was perfect. This change occupied, in the case described by Mr. Holdsworth, from the 19th to the 22nd of August. The reproductive zooid had now discarded the accessory structure essential to a free existence, and returned to the simple polypite condition.

On the 1st of September, eight of the ten arms had become detached and were leading an independent life. They survived in this state for several days, moving about bodily to a slight extent.

On the 6th of September the manubrium was observed to raise itself and stand erect, "and whilst doing so the mouth expanded and the margin was slowly turned back until it almost reached the base; and at the same time a cloud of minute specks was expelled. After about two minutes the manubrium resumed its natural shape; but ova continued to pass out, singly or a few at a time." The margin was afterwards thrown back on several occasions, whilst the manubrium was still on its side and ova discharged more or less abundantly. Dujardin describes some of the eggs as being deposited before the disappearance of the umbrella, and tells us that they were removed from the stomach by the tentacles and glued to the sides of the vessel in which the zooid was kept. Nothing of the kind has occurred to Mr. Holdsworth, and he is inclined to regard the somewhat marvellous story as founded on a mistake. "When the animal was perfect," he writes, "one or two tentacles were frequently inserted far into the peduncle; but this was simply conveying food to the stomach, as I have often distinctly observed. I have watched an animalcule accidentally touch one of the tentacular branches, and instantaneously it, with the greater

part of the entire tentacle, has been thrust far into the throat. I cannot help thinking this may have been misunderstood, and possibly some minute and irregular projections (which exist on the tentacles besides the regular masses of thread-cells) may have been mistaken, on the tentacle's return, for ova." He adds that the arms are often applied to the glass. I have little doubt that this is the true explanation of the appearances on which Dujardin's account is based.

The ovaries form longitudinal bands in the walls of the manubrium, and seem to correspond in number with the oral lobes. They are of a pinkish colour. After the expulsion of the ova, the manubrium remains motionless for some days and gradually dissolves away.

According to Krohn, the free zooid of *Cladonema* lives on a *Conferva* at the bottom of the sea, and seldom comes to the surface.

Hab. Devonshire (Gosse). It has also occurred in the tanks in the Zoological Gardens, and abundantly in Mr. Holdsworth's aquarium.

[St. Malo (Dujardin): Messina (Krohn): Belgium (Van Ben.).]

Genus STAURIDIUM, *Dujardin*.

Der. from *σταυρὸς*, a cross.

STAURIDIA, T. S. Wright, Ed. N. P. Journal (N. S.) for April 1858.

GENERIC CHARACTER.—*Stems simple or branched, rooted by a creeping, filiform stolon, the whole invested by a polypary; polypites borne at the summit of the stems, subcylindrical, with several verticils of capitate tentacula disposed in the form of a cross, and at some distance below these a single verticil of false tentacles, or tactile organs, rigid, filiform, and covered with palpicils towards the free extremity,*

gonophores borne on the body of the polypite and originating free medusiform zooids.

Gonozooid: Umbrella deep bell-shaped; manubrium with a simple mouth; radiating canals 4; marginal tentacles 4, nodulated with clusters of thread-cells, and springing from ocellated bulbs.

S. PRODUCTUM, Wright.

STAURIDIA PRODUCTA, *T. S. Wright*, Edinb. N. P. Journ. for April, 1858, pl. vii. figs. 6, 8.

CORYNE CERBERUS (the young), *Gosse*, Devon. Coast, 222, pl. xiv. figs. 4-6.

Plate XII. fig. 1.

STEM smooth, simple or slightly and irregularly branched; POLYPITES elongate, reddish, the oral extremity opaque white, with 12 tentacles (in the adult state) disposed in three whorls of four, furnished with numerous palpocils, the capitula of the uppermost row larger than the rest; false tentacles (taetile organs) 4-6, usually suberect; GONOPHORES borne at the base of the lower tentacles, pyriform, slightly pedunculate, of a pinkish colour, not more than one or two on a polypite.

GONOOID.—UMBRELLA (at the time of liberation) deeply bell-shaped, studded with thread-cells; MANUBRIUM of moderate length, rose-coloured; MARGINAL TENTACLES springing from rose-coloured bulbs, on one side of which is a dark reddish-brown ocellus, very extensile, set along their entire length with knot-like clusters of thread-cells, and terminating in a spherical bulb.

I HAVE already pointed out the identity of the gonozooid of this species, at the time of liberation, with that of *Syn-coryne eximia* (Allman), a member of another genus*. While within the capsule the marginal portion of the disk is folded in, and the knotted arms lie in the interior of the umbrella.

* Ann. N. H. for December 1862.

After a time, the investing sac is ruptured by the frequent and vigorous movements of the gonozoid, and the involved portion of the disk, bearing the tentacles, is slowly forced out. In a case which came under my observation, half the margin, with two tentacles, was first pushed out; after a few more violent spasms the other half followed; and almost immediately the little crystal sphere, with its rose-coloured pendant and four rose-coloured tubercles, from which as many beaded arms depended, liberated itself and moved gracefully through the water.

The *Sarsia turricula* of Prof. M'Crary's paper on "the *Gymnophthalmata* of Charleston Harbour" (Proc. of Elliott Soc. of Nat. Hist. vol. i. 138, pl. viii. figs. 6-8) appears to be identical with the gonozoid of *S. productum*. His account, however, of the *Coryne* from which he supposed it to proceed does not enable me to determine the species with certainty.

The arms of the *Stauridium*, as of the *Athecata* generally, increase in number with the age of the polypite. The young are found with only two, three, or four of the capitate tentacles, placed a little below the oral aperture; after a time the second verticil is developed, and then the third. The row of false tentacles seems to be produced contemporaneously with the first series of capitate arms. The *Coryne Cerberus* of Gosse is founded on an immature specimen of the present species.

Hab. Caroline Park, near Edinburgh, on *Plumularia falcata* (T. S. W.): Ilfracombe, in rock-pools on the Capstone, very abundant (T. H.).

Family VII.—Clavatellidæ.

POLYPITES *with a single verticil of capitate tentacula surrounding the base of the proboscis.* GONOOIDS *ambulatory.*

Genus CLAVATELLA, *Hincks*.

Der. Diminutive of *Clava*, a club.

GENERIC CHARACTER.—*Stems simple and very short, rising from a creeping filiform stolon, the whole invested by a polypary; polypites borne on the summit of the stems, with a single verticil of capitate tentacula round the base of the proboscis.*

Gonozooids ambulatory, developed in clusters on the lower portion of the body of the polypite, not enclosed in an investing sac (ectotheca). Umbrella wanting; radiating canals 6 or (occasionally) 4; marginal tentacles bifurcate, the outer branch capitate, the inner clavate and terminating in a suctorial disk; an ocellus at the base of each tentacle.

CLAVATELLA is nearly related to the *Eleutheria* of De Quatrefages, at least so far as the free zooid is concerned. The polypites of the latter genus have not yet been discovered. They are probably extremely minute, like those of *Clavatella*, which had escaped detection until very recently, though widely and abundantly distributed.

These are the only genera at present known in which the gonozooids are ambulatory. That of *Clavatella* is a pretty agile walker and climber, at one time using its suctorial disks as feet, and moving with ease even up the perpendicular sides of a glass vessel, at another employing them as hands, and climbing amongst the branches of the seaweed. That of *Eleutheria*, on the contrary, seems to be chiefly scansorial in its habits. Both the branches of its tentacles are surmounted by the globular heads, armed with thread-cells; the special locomotive organ is wanting; and we are not surprised, therefore, to read in M. de Quatrefages's interesting 'Mémoire' that it drags itself with difficulty over a smooth surface, but displays con-

siderable activity as soon as it reaches a tuft of coralline or weed. *Eleutheria* keeps the mouth turned upwards when it moves; *Clavatella*, on the contrary, always carries it below.

The important difference in the tentacles, accompanied as it is by a corresponding difference in habits and mode of life, must be accounted a generic distinction, and *Clavatella*, therefore, is not to be ranked as a mere synonym of *Eleutheria*.

Considerable diversity seems to prevail in the number of the arms. I have never met with more than six, and Krohn* in his very valuable paper gives the same number. Claparède†, however, states that in most of his specimens there were eight. Filippi‡ would regard this difference as specific; but of his own specimens, while a large proportion had six arms, 15 per cent. had seven. The number is so variable that it cannot be accounted a character of any special significance. The radiating canals also vary in number, according to the observations of Claparède, but never exceed six.

I have already pointed out§ the close resemblance which there is between the reproductive zooid of *Clavatella* and the alimentary polypite. In no Hydroid is the structural identity of these two elements so apparent as in the present species. The sexual zooid is a free polypite, with the lower portion of its arms united by a membrane closely investing the base of the proboscis, and the upper portion furnished with a sucker-bearing fork. If the mem-

* "Observations on the Structure and Reproduction of *Eleutheria*, Quatrefoi," Wiegmann's Archiv, 1861, p. 157.

† Beobachtungen über Anatomie und Entwicklungsgeschichte Wirbelloser Thiere.

‡ Mem. della R. Acad. d. Sci. di Torino, (ser. 2) tom. xxiii.

§ "On *Clavatella*, a new genus of Corynoid polypes, and its Reproduction," Ann. N. H. for Feb. 1861.

branch were extended into a bell, it would be converted into a (so-called) medusoid; an equally slight modification would change it into an ordinary polypite. It is easy to recognize in the short and wide radiating canals the basal portions of the tentacles involved in the connecting web. The canal, according to Krohn, runs down in the axis of the arm, and penetrates each branch, reaching to its extremity.

The only additional elements besides are the circular canal and the ocelli, which may be regarded as simple organs of sense and the natural accompaniments of a free and independent existence.

The arms of the sexual zooid, divested of their locomotive appendages, bear an *exact* resemblance to those of the alimentary polypite, even exhibiting the same number of opaque-white patches in precisely the same positions; indeed the general resemblance of the two, before the liberation of the gonozoid, is most striking; it is only after its liberation, when it is seen striding along on its stilt-like legs, the proboscis hanging down as in the swimming forms, that the close relationship is disguised by the change of posture and habit.

The ova in this genus are produced in the extreme posterior portion of the body, between the ectoderm and endoderm (Plate XII. fig. 2, *a*). The two membranes are separated more and more widely as the embryos multiply and increase in size, and the body of the zooid becomes much distended. At last the outer wall is ruptured, and the contained young are successively liberated. The males are much less common than the females.

The gonozoid of *Clavatella* multiplies rapidly by gemmation, the buds being developed in the interradial spaces, close to the periphery of the body. Gemmation is confined to the spring, and later on in the season gives place to the production of ova, as in the common *Hydra*.

C. PROLIFERA, Hincks.

CLAVATELLA PROLIFERA, *Hincks*, Ann. N. H. (3rd ser.) vii. 73, pl. vii. & viii;
Allman, Ann. N. H. for May 1864.

ELEUTHERIA, *Krohn*, in Wiegmann's Archiv, 1861, 157; *Agassiz*, N. H. U.S.
iv. 341.

Plate XII. figs. 2, 2 a.

STEM very short, supporting a single polypite, the polypary smooth and delicate; POLYPITES linear-cylindrical, becoming clavate above, very extensile, the oral extremity and centre of the body opake white; tentacles (in the mature zoophyte) 8, with large globular tips; a patch of opake white just below the capitulum, and another towards the base.

GONOOIDS in two opposite clusters, hemispherical, yellowish white; RADIATING CANALS very short and wide; PROBOSCIS funnel-shaped, opake white; MARGINAL TENTACLES variable in number (6, 7, 8), the capitate portion resembling exactly the arm of the polypite; a dark-red ocellus at the base of each tentacle.

THE polypites of this exquisite species possess a remarkable power of altering the dimensions of the body. At times they are greatly elongated and attenuated, and present the appearance of most delicate milk-white threads*. If disturbed, they suddenly contract, and assume a flask-like form. The body during extreme extension is about $\frac{1}{3}$ inch in length.

The tentacles vary in number with age, but do not seem to exceed eight, four of which are held erect and four depressed. The capitula are large, and thickly covered with thread-cells. The movements of the polypite are extremely graceful; and the extensibility both of the body and tentacles gives it great advantages in pursuit of prey.

During the summer and autumn months, reproductive

* The endoderm is white, invested by a transparent ectoderm.

buds are almost always present; they are constant in position, forming two clusters at opposite points on the lower portion of the body. Each cluster consists of three or four buds in various stages of development, from a simple excrescence on the surface of the body to the fully formed zooid. As it approaches maturity, the movements of the gonozooid become frequent and vigorous; and at length the pedicle by which it is attached gives way, and it enters upon its term of free existence, moving about by means of its suctorial disks. It now bears a considerable resemblance to a Lilliputian starfish. In its movements and mode of life it presents a marked contrast to the medusiform zooid of other Hydrozoa. The latter is active and mercurial, dancing gaily through the water by means of the vigorous strokes of its crystalline swimming-bell. The former strides leisurely along, or, using the adhesive disks as hands, climbs amongst the branches of the weed. In the latter stage of its existence it becomes stationary, fixing itself by means of its suckers; and thus it remains, the capitate arms standing out rigidly, like the rays of a starfish, until the embryos are ready to escape.

Claparède states that he has met with specimens in which there were two ocelli at the base of each arm.

Clavatella prolifera was first discovered at Torquay. It occurred in the small basins scooped out in the masses of limestone with which the shores of Torbay are, in many parts, so thickly strewn, amongst forests of *Laomedea flexuosa* and companies of the daisy-anemone in possession of every chink and cranny, and scattered colonies of the exquisite little *Zoanthus sulcatus*. It is found universally in the higher and smaller pools, and prefers such as are clean and not much overgrown by weed. It requires close observation and a keen eye to detect the presence of the polypites, which are like the finest threads. In a

strong light their milk-white colour betrays them. At the proper season, the ambulatory zooids may be obtained abundantly in the small tufts of algæ that stud the bottom and sides of the pools.

Clavatella has a very definite range on the coast, not descending, so far as I have observed, below the higher zone of the littoral region. Its diffusion is limited, no doubt, by the structure and habits of its ambulatory gonozooid.

Hab. Torquay: Ilfracombe: Filey Brigg, Yorkshire: Whitby (T. H.).

[Nice (Krohn).]

Family VIII.—Myriothelidæ.

POLYPITES solitary *, with very numerous, minute, capitate tentacula scattered over the body.

Genus MYRIOTHELA, Sars.

Der. *μυρίος*, innumerable, and *θηλή*, a nipple.

CANDELABRUM, De Blainville.

ARUM, Vigurs.

SPADIX, Gosse.

GENERIC CHARACTER.—*Polypites solitary*, cylindrical, terminating above in a conical proboscis, springing from an adherent base, which is clothed with a chitinous polypary; tentacles very small, capitate, covering the greater portion of the body.

Gonophores borne on coryniform processes, clustering round the base of the polypites, and containing fixed sporosacs.

THIS curious form was first described by Otho Fabricius in his 'Fauna Grœnlandica,' under the name of *Lucernaria*

* This term is used to denote that there is only a single primary or alimentary polypite. (*Vide* next page.)

phrygia. He states that he referred it provisionally to this genus, and that in many points it was closely related to *Hydra*. De Blainville (in 1834), neglecting this hint, and failing altogether to appreciate its true affinities, separated it much more widely from its kindred, and assigned it a place near *Sipunculus*, under the generic name of *Candelabrum*. In 1849 it was rediscovered by Sars, who gave an admirable account of it as *Myriothela arctica*, and placed it amongst the Hydroida, between his *Coryna* and *Syncoryna*. He did not at the time recognize the identity of his zoophyte with the *Lucernaria phrygia* of Fabricius; but many years after, at a meeting of the Northern Scientific Association, he announced that he had seen a specimen of the latter in the University Museum at Copenhagen, and that it was neither more nor less than the *Myriothela*.

Agassiz has lately restored the genus *Candelabrum* of De Blainville, on the ground of priority of date; but as this author was wholly ignorant of the true nature of the animal, and has left us no description of it that is of any scientific value, his generic name must properly give place to that of Sars, who was the first to characterize it adequately*. The original specific designation conferred by Fabricius must be retained.

Myriothela is usually described as a solitary polypite; it would perhaps be more correct to say that it is a cluster of polypites, one of which is fully developed and of large size and acts as the alimentary zooid, while the others are small and rudimentary and support the reproductive buds. The peculiarity is the development of the prolific zooids on the base of a single primary polypite instead of on the cœnosarc as in *Hydractinia* &c.

Mr. Alder has suggested the probability of a close affinity between *Myriothela* and the *Acaulis* of Stimpson, and

* *Vide* Allman, "Notes on the Hydroida," Ann. N. H. for July 1864.

would place it in the family of the *Tubulariidae*. To this view I am unable to assent, although it has received a certain measure of support from Prof. Allman. The *Acaulis* is furnished at first with a verticil of filiform tentacles near the base of the polypite (though they are said to disappear subsequently); and between these and the upper capitate tentacles the reproductive buds are developed on the body. But *Myriothela*, so far as we know, is destitute of basal tentacles at all stages of its existence, and the gonophores, instead of being borne on simple or branched pedicels as in the *Tubulariidae*, are produced on distinct coryniform zooids—small, rudimentary polypites, which are homologous with the (so-called) gonoblastidia of *Hydractinia* or *Dicoryne*. It is, as I have said before, a cluster of polypites nearly related to *Coryne*; but its marked peculiarities would seem to entitle it to stand as the type of a separate family.

M. PHRYGIA, Fabricius.

LUCERNARIA PHRYGIA, *Fabr.* Faun. Grœnland. 343.

CANDELABRUM PHRYGIUM, *De Blainv.* Actinolog. 318.

MYRIOTHELA ARCTICA, *Sars*, Zoolog. Reise i Lofoten og Finmarken, 14; *Gosse*, Marine Zool. 19, fig. 25.

ARUM COCKSII, *Vigurs*, Rep. Roy. Polytech. Soc. 1849.

SPADIX PURPUREA, *Gosse*, Ann. N. H. (n. s.) xii. 125.

CANDELABRUM ARCTICUM, *Agassiz*, N. H. U. S. iv. 341.

Plate XII. fig. 3.

POLYPITE cylindrical, very extensile; tentacles extremely numerous and closely set, covering about three-fourths of the body, with a reddish-brown spot on the capitulum; the basal portion of the body minutely speckled with white, and crowded with the processes bearing the gonophores, which are slender, pointed above, with a few minute wart-like tentacles on the upper portion; GONOPHORES produced a little below the tentacles, sessile, globular, when mature of a very large size and a pink

colour; the ADHERENT BASE massive, of a dark horn-colour, sending out a few tubular and root-like prolongations. Embryo actiniform.

THIS extraordinary Hydroid is remarkable for mutability of form and vigour of movement. The body when elongated extends at times to as much as an inch and a half in length. In its contracted condition it is somewhat fusiform; but Sars's epithet "cylindrical" is strictly applicable to it when extended. For about three-fourths of its length the body of the primary polypite is completely covered by the small capitate tentacles (Plate XII. fig. 3, c), which, with their reddish tips, give a mottled or variegated appearance to the surface. The basal portion bears a dense cluster of the small prolific polypites on which the reproductive buds are developed; these may be seen in frequent and vigorous motion. They bear a close resemblance to minute *Corynes*, having a few tentacles on the upper portion of the body and carrying the gonophores below them. They seem to be destitute of a mouth. As in *Coryne*, the reproductive bodies attain a very large size. The actiniform embryo has been observed by Mr. Cocks and Mr. Alder; it continues "free for several days, and perambulates on its stilt-like legs with ease and agility."

Sars describes *Myriothela* as destitute of a polypary; but in fact it springs, like others of its tribe, from an adherent base sheathed in chitine, though it is sometimes inconspicuous and difficult to detect.

Hab. Under stones, at extreme low water, Gwyllyn Vase, near Falmouth (Cocks): Lulworth: Weymouth, numerous under stones and on rocky ledges at spring tides (Gosse): Meadfoot, Torquay, on stone (T. H.): Ilfracombe, dredged (Leipner).

[Greenland (Fabricius): Tromsö, in 20-30 fathoms attached to stones or *Sertulariæ* (Sars).]

Family IX.—Eudendriidæ.

Polypites borne on a well-developed stem, with a single verticil of filiform tentacula surrounding the base of a large trumpet-shaped proboscis.

Genus EUDENDRIUM, *Ehrenberg* (in part).

Der. εὖ well, and δένδρον a tree.

GENERIC CHARACTER.—*Stem branched, rooted by a creeping filiform stolon, the whole invested by a chitinous polypary; polypites borne at the extremity of the branches, vase-shaped or roundish, with a prominent, trumpet-shaped proboscis and a single verticil of filiform tentacula round the base of it. Gonophores developed from the body of the polypite below the tentacles, or from the stem, containing fixed sporosacs—the female simple, the male consisting of several chambers arranged in moniliform series.*

THE *Eudendria* form a well-marked group. They are most of them of decidedly arborescent habit, and bear graceful and often brilliantly coloured polypites, which are remarkable for their conspicuous funnel-shaped proboscis. Fig. 6.

The gonophores are generally developed on the body of the polypite, but sometimes occur on the stem. In many cases the fertile polypite is atrophied and disappears, and the reproductive buds hang in umbelliform clusters at the extremity of the branches.

The male sporosac is ultimately polythalamic, consisting of several chambers placed one above another (woodcut, fig. 6). In its first stage it consists of a simple spherical sac, borne on a peduncle, and enclosing a manu-



brium, in the walls of which the spermatie mass is developed. Gradually, however, the peduncle lengthens, and a second sperm-sac is formed upon it immediately below the first; sometimes a third follows below the second; but this seems to be commonly the limit. This polythalamie structure is a very simple modification of the ordinary gonophore. The female sporosac contains a single ovum, which is more or less encircled by the loop-like spadix (woodcut, fig. 7).

Fig. 7



According to Agassiz the colour of the polypite sometimes differs in the two sexes*.

The genus *Eudendrium* is widely distributed in the European Seas, and has representatives in North America. One of these (*E. tenue*, A. Agass.) I believe to be identical with a British species, and *E. ramosum*, according to M'Crary, has been found at Charleston. *E. rameum* occurs near the North Cape, as well as abundantly on our own shores, and ranges to the Mediterranean. Sars describes a new species (*E. pusillum*) found near Messina, and Stimpson reports one (*E. cingulatum*) as occurring at Grand Manan, Bay of Fundy.

1. *E. RAMEUM*, Pallas.

TUBULARIA RAMEA, Pallas, Elench. 83; *Johnst. B. Z.* (1st ed.) 117, pl. v. figs. 1, 2; *Dalyell*, Rem. An. of Scotl. i. 50, pls. vi.-x.

THOA SAVIGNYI, Lamæ. Expos. Méth. 15.

TUBULARIA RAMOSA, *Johnst. Trans. Newc. Soc.* ii. 253, pl. x.

EUDENDRIUM RAMEUM, *Johnst. B. Z.* (2nd ed.) 45, pl. v. figs. 1, 2; *Landsborough*, Pop. Hist. B. Z. 107, pl. ii. fig. 5; *Alder*, North. & Durh. Cat. in *Trans. Tynes. F. C.* iii. 103; *T. S. Wright*, Ed. New Phil. Journ. (N. S.) for Jan. 1859, pl. ii. figs. 1, 2.

Woodcut, fig. 8.

ZOOPHYTE *tree-like*, much and irregularly branched; MAIN

* *Vide* his account of *E. dispar*, N. II. U. S. vol. iv. p. 288.

STEM (trunk) *thick and coarse, composed of many agglutinated tubes, of a dark brown colour*; PRINCIPAL BRANCHES *compound below, but running out into a single tube towards the extremity*, much ramified; BRANCHLETS simple, alternate, with a few slight rings at their origins; POLYPITES vase-shaped, of a reddish colour, with 24 muricate tentacula; GONOPHORES (male) in umbelliform clusters, (female) oval, borne on the polypite or scattered over the stem below it, containing a single yellow ovum.

Average height, when full-grown, 6 inches.

“THIS is a splendid animal production—one of the most singular, beautiful, and interesting among the boundless works of nature. Sometimes it resembles an aged tree, blighted amidst the war of the elements, or withered by the deep corrosions of time; sometimes it resembles a vigorous flowering shrub in miniature, rising with a dark-brown stem, and diverging with numerous boughs, branches, and twigs, terminating in so many hydræ, wherein red and yellow intermixed afford a fine contrast to the whole.”

So writes Sir John Dalyell with justifiable enthusiasm. The dredger will meet with no more beautiful sight than a fine specimen of this zoophyte, bearing, it may be, a thousand of the flower-like polypites, and laden with its bright-yellow fruit. Its resemblance to an aged tree in miniature is equally striking.

E. rameum is rooted by a dense, sponge-like mass of fibres, and sometimes attains a height of eight or nine inches.

The male gonophores as well as the female are developed from the polypite; but complete atrophy of the latter seems to take place chiefly in the case of the male, and the gonophores of this sex are almost always met with in an advanced state as umbelliform clusters. The embryo on issuing from the female sac is a large bright-yellow planule.

Hab. Deep water, on shells, stones, &c. ; widely distributed. It is found in Shetland, in the Clyde, and along the eastern coast of Scotland and England ; very abundantly at Lytham, in Lancashire ; sparingly in Cornwall (off the Deadman) : in Ireland (east coast).

[Tromsö and Hammerfæst in 30 fath. (Sars): Mediterranean (Pallas).]

2. *E. RAMOSUM*, Linnæus.

SMALL RAMIFIED TUBULAR CORALLINE, *Ellis*, Corall. 31, pl. xvi. fig. *a*, ? pl. xvii. figs. *a*, *A*.

TUBULARIA RAMOSA, *Linn.* Syst. 1302 ; *Lamk.* An. sans Vert. (2nd ed.) ii. 126 ; *Lamx.* Expos. Méth. 17.

(?) SERTULARIA RACEMOSA, *Cavolini*.

TUBULARIA TRICHOIDES, *Pallas*, Elench. 84.

EUDENDRIUM RAMOSUM, *Ehrenberg*, Corall. roth. Meer. 72 ; *Johnst.* B. Z. 46, pl. vi. figs. 1, 2, 3.

Plate XIII.

ZOOPHYTE pinnately branched ; MAIN STEMS *consisting of a single tube, long and slender, straight, of a chestnut-brown colour*, smooth, or with ringed spaces irregularly distributed ; BRANCHES *alternate, slightly constricted at their origins and ringed above them*, bearing short, sub-erect ramules, which are more or less annulated ; POLYPITES large, of a pinkish colour, with about 24 long white tentacles.

Height about 6 inches.

THE long, simple stems, which are generally of a dark rich horn-colour, and the slender habit distinguish this species from the preceding. While there is a good deal of variability in the branching, it never assumes the truly arborescent character that belongs to *E. rameum*. There is often a considerable amount of annulation on the stems ; but it is irregularly distributed *.

* "Tubulis * * * alterne ramosis passimque annulatis."—*Pallas*.

Hab. On shells &c., generally distributed round the coasts of Great Britain and Ireland.

3. E. ANNULATUM, Norman.

“On undescribed British Hydrozoa, Actinozoa, and Polyzoa,” Ann. N. H. for Jan. 1864, 83, pl. ix. figs. 1–3.

Plate XV. fig. 1.

ZOOPHYTE *shrubby, densely branched, of a bright full horn-colour*; MAIN STEMS very thick and *strengthened by a network of anastomosing tubes on their surface*; RAMULES *extremely numerous, short, and delicate, closely and distinctly annulated throughout*; POLYPITES with from 16–20 tentacles; GONOPHORES (? male) in clusters, oval, and shortly stalked, from 8–20 in a group. Height 4 inches.

THE shoots rise from an incrusting mat, which consists of a close network of broad and somewhat flat anastomosing fibres. The dense shrubby habit, the regular annulation, and the curious superficial network are distinctive characters of this fine species.

We know little of the reproduction; but, as in other *Eudendria*, the fertile polypite is, ultimately at least, merely rudimentary.

Hab. “Found in a cave known as ‘Buness Hall,’ which is one of many caverns, all remarkably rich in animal life, which penetrate the cliffs on the eastern side of Burrafirth, the northernmost of the fies of Shetland. It was attached to the perpendicular sides of this cavern, about a foot beneath the water at the lowest spring tide. Other, but much smaller, specimens were inhabiting a rock-pool just outside the cave. These last examples, though not more than an inch or an inch and a half high, were loaded with

reproductive bodies, which, however, were wholly absent from their larger brethren in the eave" (A. M. N.).

4. *E. ARBUSCULA*, T. Strethill Wright.

"Observations on Brit. Zooph.," Edinb. New Phil. Journ. for July 1859, 113, pl. ix. fig. 5.

Plate XIV. fig. 1.

ZOOPHYTE *much and densely branched*; MAIN STEM *formed of a number of tubes agglutinated together, of a dark horn-colour*; BRANCHES also compound towards the base, becoming simple above, often much divided and subdivided, bearing numerous slender and transparent ramules, more or less ringed, which support the polypites; POLYPITES *white*, with many tentacula, and a ring of large thread-cells round the base of the body; GONOPHORES (male) *borne in clusters on short stems, springing at right angles from the branches, the summit crowned with a tubercle, containing barbed thread-cells*; (female) unknown.

THIS species forms bushy tree-like tufts, from 1 to 2 inches in height, and thickly clothed with snowy polypites. The branches are ringed near their insertions.

The male reproductive bodies are distributed in clusters over the zoophyte. Each spermary usually consists of two spherieal sacs, one above the other, borne on a rather long peduncle, the uppermost surmounted by the curious tubercle, with its battery of thread-cells.

Hab. Queensferry, Firth of Forth (T. S. W.).

5. *E. CAPILLARE*, Alder.

EUDENDRIUM CAPILLARE, *Alder*, North. and Durh. Cat. in Trans. Tynes. F. C. iii. 105; t. iii. figs. 9-12; *Hincks*, Devon and Cornw. Cat., Ann. N. H. x. (3rd ser.) 360.

CORYMBOGONIUM CAPILLARE, *Allman*, Ann. N. H. for Aug. 1861, 168.

DICORYNE CAPILLARE, *Alder*, Supp. North. and Durh. Cat. in Trans. Tynes. F. C. v. 230.

? EUDENDRIUM TENUE, *A. Agassiz*, North Amer. Acalephæ, 160, fig. 250.

Plate XIV. fig. 2.

STEM *very slender and thread-like, pale horn-coloured, and very transparent*, irregularly branched; BRANCHES *of equal thickness with the main stems*, ringed at their origin; POLYPITES vase-shaped, yellowish brown, with an opaque-white proboscis and between 20 and 30 long slender tentacles; GONOPHORES (*male*) *clustered, borne on short ramules, delicately annulated, springing from the lower part of the stem or the creeping stolon*, raised on peduncles, and with a tubercle on the summit; (*female*) somewhat oval, pedunculate, ranged round the body of the polypite*.

Height of zoophyte from $\frac{1}{2}$ to $\frac{3}{4}$ inch.

THIS species is remarkable for its great delicacy and transparency. The smooth and slender stems are just tinged with the faintest horn-colour.

The male sporosæes hang like clusters of fruit from the extremity of very short branchlets, which occur only on the lower portions of the stem or on the stolon, the barren polypites crowning the summit of the superior branches. The gonophores are furnished with a tubercle at the top, like those of *E. arbuscula*.

Hab. On *Antennularia ramosa*, Embleton Bay, Northumberland (R. Embleton): Firth of Forth, on *Delesseria sanguinea*, from about 4 fathoms (G. J. A.): Torbay, on

* There is very little variation in the gonophores amongst the species of *Eudendrium*. The males are usually clustered, the polypite that gives origin to them disappearing in great part as they advance to maturity. The polypite that bears the female gonophores seems to be less subject to atrophy, which, however, probably sets in before the liberation of the ova.

Salicornaria farciminoïdes &c., not uncommon; near Polperro, Cornwall (T. H.).

6. *E. VAGINATUM*, Allman.

"Notes on the Hydroida," Ann. N. H. for Jan. 1863, (ser. 3) xi. 10.

ZOOPHYTE much branched, *polypary deeply and regularly annulated throughout*; POLYPITES *vermilion*, with about 18 tentacula,—*the body, as far as the origin of the tentacles, enveloped in a loose corrugated membranous sheath*, which loses itself posteriorly upon the polypary; REPRODUCTION unknown.

Height about $1\frac{1}{4}$ inch.

Hab. "In rock-pools at extreme low water, spring tides, Shetland" (G. J. A.).

7. *E. INSIGNE*, Hincks.

EUDENDRIUM INSIGNE, *Hincks*, Devon and Cornw. Cat., Ann. N. H. (ser. 3) ix. 159 and 297, pl. vii. fig. 2.

„ HUMILE, *Allman*, Ann. N. H. for Jan. 1863, (ser. 3) xi. 9.

Plate XIV. fig. 3.

ZOOPHYTE *delicate*, more or less branched; *stem and branches closely ringed throughout*; POLYPITES rather large, vase-shaped, with about 20 tentacles, red, with a shade of yellow or brown; GONOPHORES (male) destitute of a terminal tubercle; (female) globose, on short stalks, of an orange colour.

Height (commonly) about a quarter of an inch, sometimes more.

THE polypary of this species is distinctly annulated throughout, like that of a *Coryne*. The polypites are very graceful in form, and of a reddish-brown colour; the proboscis, as is very commonly the case in this and

allied genera, is opaque white, and thickly paved with large thread-cells. There is a circular groove near the base of the body, from which the gonophores spring—a portion of the structure which I misinterpreted at first, and which led me to suppose that there was a shallow cup round the base of the polypite.

The polypites bearing the reproductive buds are not confined to any particular portion of the zoophyte, but are irregularly distributed. In this species I have sometimes found male gonophores borne on fully developed polypites. In other cases they form mere clusters at the extremity of the branches.

I have little hesitation in identifying the present species with the *E. humile* of Allman. His specimens were obtained in much the same locality as those from which I originally described the species, but were of somewhat larger growth. His variety *corymbifera* is probably founded on examples of *E. insigne* in which the fertile polypites were atrophied.

Hab. Torquay, on rocks between tide-marks; Ilfracombe; Swanage, Dorset (T. H.).

Family X.—Atractylidæ.

Polypites borne on a stem, with a single wreath of filiform tentacula surrounding a conical proboscis.*

Genus ATRACTYLIS, T. S. Wright (in part).

Der. ἄτρακτος, a spindle.

GENERIC CHARACTER.—*Cænosarc sheathed in a chitinous*

* The stem is sometimes rudimentary, and a few species occur in which, so far as our present knowledge of them goes, it is suppressed altogether; but the development of a stem is a prevailing characteristic of the group.

polypary; stems erect, funnel-shaped, developed at intervals on a creeping stolon; polypites emerging from the summits of the stems, into which they are retractile, fusiform, with a conical proboscis, surrounded by a single verticil of filiform tentacula. Reproduction by fixed sporosacs, which are invested by a chitinous envelope and borne on the sides of the stem.

ATRACTYLIS is distinguished from *Perigonimus* solely by its mode of reproduction. A simple fixed sae takes the place in this genus of the medusiform zooid. The ovary contains a very large number of eggs, developed as usual between its two component layers; and these at a certain stage are forced, after "a most laborious process of parturition"* , through the ruptured wall of the sae into a kind of gelatinous nest which crowns it (Plate XVI. fig. 1 *b*). There they are matured into planules. This extraeapsular *nidus* is not uncommon in the next suborder (*Thecaphora*). *Sertularia pumila* and *Calycella syringa* offer examples of it.

A. ARENOSA, Alder.

ATRACTYLIS ARENOSA, Alder, Supp. North. Cat. in Trans. Tynes. F. C. v. 231, pl. ix. figs. 5-7; T. S. Wright, Mier. Journ. (N. S.) iii. 47, pl. iv. figs. 7-10.

Plate XVI. fig. 1.

STEMS short, funnel-shaped, generally covered with minute grains of sand or with mud; POLYPITES milk-white, with long, slender tentacles alternately elevated and depressed, 6-12 in number, according to age; GONOPHORES pyriform, shortly stalked, borne on the lower half of the stem, usually two in number, one opposite to the other.

THE stems of this species, though somewhat irregular in

* *Vide* "Observations on Brit. Zoophytes," by Dr. T. Strehill Wright, Microscop. Journ. vol. iii. (N. S.).

form, expand gradually from the base to the top, and do not present the eup-shaped enlargement above, which is characteristic of *Perigonimus repens*, a near ally. The sanded surface is also a good distinctive mark. The gonophores are generally two in number, but three sometimes occur; they are constant in position, and produce an immense number of ova.

Hab. On the undersides of stones and the roots of *Laminariæ* at Tynemouth and Cullerecoats, occasionally (J. A.): Largo (T. S. W.): under stones, and on *Laminaria*-roots, Filey Brigg, very common (T. H.).

Genus PERIGONIMUS, *Sars*.

Der. *περί*, all round, and *γόνιμος*, fruit-bearing.

ATRACYLIS, T. S. Wright (in part).

GENERIC CHARACTER.—*Cænosarc sheathed in a chitinous polypary; stems branching or simple, rooted by a thread-like stolon; polypites fusiform, with a single verticil of fili-form tentacles round the base of a conical proboscis; gonophores developed from the cænosarc.*

Gonozooids free and medusiform. Umbrella (at the time of liberation) deep bell-shaped; manubrium short; radiating canals 4; marginal tentacles 2 or 4 (increasing in number with age), springing from non-ocellated bulbous bases.

A GROUP of minute zoophytes of simple habit, or with very slight branching, which usually colonize the shells and opercula of various univalve mollusks. If we except *P. linearis*, which is doubtfully referred to this genus, all the species produce gonozooids that are nearly identical in external appearance.

The *operculum* is a very favourite site for the *Perigonimus*-settlement, affording no doubt peculiar facilities for procuring an abundant supply of food. The alliance is far from uncommon between the stationary zoophyte and the mollusk or the restless Hermit Crab, the former securing the advantages without the toils of a vagrant life, and sharing the spoil without the fatigues of the chase.

1. P. REPENS, T. S. Wright.

- EUDENDRIUM PUSILLUM, *Wright*, Proc. Roy. Phys. Soc. Edinb. 1857, p. 231, pl. ii. figs. 8, 9; Ed. N. P. Journ. (N. S.) vi. pl. ii. figs. 8, 9.
 ATRACTYLIS REPENS, *Wright*, Proc. Roy. Phys. Soc. Edinb. 1858, p. 450, pl. xxii. figs. 4, 5; Ed. N. P. Journ. (N. S.) ix. (1859,) 108, pl. i. figs. 4, 5; *Alder*, Supp. North. Cat. in Trans. Tynes. F. C. v. 230.
 PERIGONIMUS REPENS and PUSILLUS, *Allman*, Ann. N. H. for May 1864.
 PERIGONIMUS MINUTUS, *Allman*, Notes on Hydroida, Ann. N. H. for January 1863.

Plate XVI. fig. 2.

STEMS erect, *simple or bifurcate, more or less dilated and cup-shaped above*, from $\frac{1}{8}$ to $\frac{1}{4}$ inch in height; POLYPITE small, club-shaped, white, partially retractile into the upper part of the tube; tentacles from 4–12, according to age; GONOPHORES *pedicellate, borne on the stems at various heights*.

GONOOZOID.—UMBRELLA mitre-shaped, with numerous thread-cells in its substance; MANUBRIUM 4-lipped; MARGINAL TENTACLES, at the time of liberation, 4, springing from yellowish-brown bulbous bases at the termination of the radiating canals—two very long, two rudimentary*.

DR. WRIGHT first described this species under the name of *Eudendrium pusillum*. In a subsequent paper he transferred it to the genus *Atractylis*, and changed the specific name to *repens*. As such it is quoted in his own writings

* The latter seem to be sometimes undeveloped at the time of liberation, but they soon make their appearance.

and in those of other zoophytologists, and I therefore retain the later designation to avoid confusion.

He has given a graphic description of the habits of the gonozoid. "When first separated from the zoophyte, it seeks the surface of the water with long zigzag bounds, carrying its tentacles closely coiled in spirals. Having remained swimming there for a short time, it begins to sink slowly with the mouth of its bell uppermost, and the tentacles, uncoiling themselves, stream behind, to a distance of more than twenty times the length of the bell, in straight lines or graceful curves, sweeping the water in search of prey." . . . "A jar of these lively creatures, some swimming rapidly about like small frogs, with their half-coiled tentacles jerking backwards at each stroke, others descending headlong in flocks like the falling train of a rocket, and all glittering under oblique illumination in the dark water, forms one of not the least interesting of those scenes of beauty which are of daily occurrence to the naturalist."

The gonozoid at the time of detachment has only two arms fully developed; but two more are present in a very rudimentary state, or soon bud from the two smaller marginal tubercles. Dr. Wright has observed* that after a time four other tubercles appear on the marginal canal, and possibly the multiplication of the tentacles may proceed much further.

The *P. minutus* of Allman, judging from the description of it, for unfortunately we have no figure, is identical with *P. repens* in all but one or two trifling particulars. The umbrella of its gonozoid is described as having "*a somewhat conical form*" at the summit, and its reproductive buds as borne on much longer peduncles than those of *P. repens*. Now in Dr. Wright's *first* figure the swimming-

* "Observations on British Protozoa and Zoophytes," Annals N. H. for August 1861—under *Atractylis palliata*.

bell is represented as slightly produced and pointed at the top; and though in a subsequent figure it is rounded, it is fair to infer that this diversity arose from his having had the two forms under observation*. The variation I cannot regard as of much importance.

Nor is the difference in the length of the peduncle which supports the gonophore in itself a point of greater moment. These slight variations, if constant, might fairly be taken account of along with other distinctive characters; but as the sole criteria of the species they seem to me to be insufficient.

Prof. Allman also refers to the entire absence in his species of the two smaller tentacles, at the time of liberation. But Dr. Wright's latest note on his species implies that, in some instances at least, they are not developed on the gonozoid of *P. repens* till a subsequent period; and, as I have often observed (in the case of *Podocoryne carnea*), there is very great diversity in the time at which the members of the second set of tentacles make their appearance.

From these considerations, and desiring to avoid the undue multiplication of species, though I must always dissent from Prof. Allman's judgment with hesitation, I prefer to rank *P. minutus* as a synonym of *P. repens*.

Hab. On Sertularians and the Spider Crab, Firth of Forth (T. S. W.): on *Dentalium entalis*, the operculum of *Fusus antiquus*, and other shells, from the fishing-boats, Cullereboats (J. A.): (*P. minutus*) "forming a fringe round the edge of the operculum of *Turritella communis*, dredged in Busta Voe, Shetland. Out of between twenty and thirty specimens of living *Turritella* examined, not one

* I have a characteristic drawing of *P. repens* by Mr. Alder, representing the reproductive bodies *in situ*, borne on short peduncles. It is accompanied by a figure of the free zooid, in which the umbrella is distinctly produced and conical at the summit.

was free from this remarkable little zoophyte'' (G. J. A.): Ilfracombe, on stones (T. H.).

2. P. SESSILIS, T. S. Wright.

EUDENDRIUM SESSILE, *Wright*, Edinb. New Phil. Journ. (N. S.) vi. 90, pl. iii. figs. 16, 17.

ATRACYLIS SESSILIS, *Wright*, Edinb. New Phil. Journ. (N. S.) ix. 109.

PERIGONIMUS SESSILIS, *Allman*, Ann. N. H. for May 1864.

Plate XVII. fig. 1.

POLYPITES *supported on a very short ringed stem, or sessile, red or white, with 8 tentacles, sheathed up to the tentacles in a delicate membranous tube*; GONOPHORES *sessile, borne on the creeping stolon, close to the polypites, and often in pairs.*

GONOOID identical with that of the preceding species.

Hab. On shells from deep water, Firth of Forth, and on rocks about Granton (T. S. W.).

3. P. PALLIATUS, T. S. Wright.

ATRACYLIS PALLIATA, *Wright*, Ann. N. H. for Aug. 1861, 129, pl. iv. figs. 6, 7.

PERIGONIMUS PALLIATUS, *Allman*, Ann. N. H. for May 1864.

Plate XVII. fig. 2.

STEMS short; POLYPITE minute, fusiform, white, with 8 alternating tentacles, *the body clothed up to the border of the mouth with a gelatinous envelope**; GONOPHORES borne on the stolon, of large size.

GONOOID.—UMBRELLA subcylindrical, with thread-cells; MANUBRIUM 4-lipped; MARGINAL TENTACLES 2, opposite, long, the intervening canals terminating in small bulbs.

OF this zoophyte Dr. Wright says, "When first observed, its closely set and dense white polypes, surrounded by their

* "With a thick layer of 'colletoderm.'"—*Wright*.

gelatinous envelopes, were mistaken for a mass of minute ova * * * *. The medusoids are of great size when compared with the very minute polype, and resemble exactly those of *Atractylis* (*Perigonimus*) *repens*. I have not witnessed any further development in them after their separation from the zoophyte.”

Hab. On a shell inhabited by *Pagurus Bernhardus*, at Granton, Firth of Forth (T. S. W.).

4. *P. VESTITUS*, Allman.

“Notes on the Hydroida,” Ann. N. H. for July 1864.

STEMS *from half a line to two lines in height, greatly dilated towards the summit, simple, or occasionally with one or two short branches; POLYPARY yellowish brown, with adherent particles of sand; POLYPITES with from 6–10 tentacles, usually held in extension, alternately elevated and depressed, a delicate continuation of the polypary extending over the whole of the body beyond the tentacles and almost to the margin of the mouth; GONOPHORES produced, for the most part, on the stem, occasionally on the stolon, borne on long peduncles, which are invested for about half their length by the polypary.*

GONOOID.—UMBRELLA (*at the time of liberation*) *oviform, much contracted towards the mouth, the walls very thin and with minute thread-cells immersed in them; MANUBRIUM with four shallow lips; MARGINAL TENTACLES 2, opposite, with non-ocellated bulbous bases, the intervening radiating canals terminating each in a smaller bulb.*

THE only character of any importance, so far as I can judge, which separates this form from the *P. palliatus* of Wright is the shape of the umbrella at the time of liberation. In Prof. Allman’s specimens the bell was contracted towards the mouth, and was therefore oviform, instead of cylindric as in Dr. Wright’s zoophyte. The other dif-

ferences noted by Allman are, that in *P. vestitus* the stem is rather more developed, and that its reproductive bodies are chiefly (but not exclusively) borne on the stem, whilst those of *P. palliatus*, as observed by Wright, were confined to the creeping stolon. Further investigation may probably show that the two forms must be united; it is certainly needed to prove that they are distinct.

Hab. On an old *Buccinum*-shell, Firth of Forth, associated with *Hydractinia echinata* (G. J. A.).

5. *P. SERPENS*, Allman.

“Notes on the Hydroida,” Ann. N. H. for January 1863.

Plate XVI. fig. 3.

STEMS *erect, short, simple, tapering slightly downward*, about 2 lines in height; POLYPARY delicate, transparent, *not dilated at the base of the polypites*; POLYPITES *reddish orange*, retractile, *the body oval, with about 12 or 14 tentacles*, which are held in complete extension, alternately elevated and depressed; GONOPHORES produced on the creeping stolon, and elevated on rather long peduncles.

GONOOID.—UMBRELLA dome-shaped (at the time of liberation), with the vertical slightly exceeding the transverse diameter; MANUBRIUM *reaching to about one-half the depth of the bell, with a simple mouth*; MARGINAL TENTACLES 2, opposite, very extensile, and with large reddish-orange bulbs at the base, the intermediate radiating canals terminating each in a very small bulbous dilatation.

THIS is a very brilliant little zoophyte. The polypites, during complete extension, are almost cylindrical, and rise a good way above the top of the stem. They are of a vivid reddish-orange colour, with the exception of the tip of the proboscis, which is whitish. The ecenosarc is of the same bright tint as the body of the polypite, so that a colony presents a very gay appearance.

The polypary of this species is extremely delicate, yielding like a mere skin to the movement of the polypites.

Hab. On the stems of *Halicornaria setacea*, from about 12 fathoms, Torbay (G. J. A.) : on rocks and *Laminaria*, under the lower ledges, Capstone, Ilfracombe ; Filey Brigg (T. H.).

Species doubtfully referred to this genus.

P. (?) LINEARIS, Alder.

ATRACTYLIS LINEARIS, Alder, Supp. North. Cat. in Trans. Tynes. F. C. v. 230, 231, pl. x. figs. 1-3.

PERIGONIMUS ? LINEARIS, Allman, Ann. N. H. for May 1864.

Plate XVII. fig. 3.

STEMS *linear*, horn-coloured, unbranched, (?) nearly smooth, a little undulating, and slightly wrinkled on the lower part; POLYPITE slender, retractile—with 8 long tentacles, alternately elevated and depressed; GONOPHORES *pear-shaped or subglobular*, set two or three together on the stem.

GONOOID.—UMBRELLA globose, slightly truncate below, with a contracted aperture; MANUBRIUM inconspicuous, branched at the base; MARGINAL TENTACLES 4, subelavate, springing from semicircular yellowish lobes.

Height of zoophyte $\frac{1}{4}$ inch.

THE stems of this species rise much higher, and are proportionally more slender, than those of *P. repens*, and are not so much expanded at the aperture. In the young state, however, it is difficult to distinguish the two species. The gonozoids are very different; but we need a fuller and more precise description of those of *P. linearis* than the condition of Mr. Alder's specimens permitted him to give.

Hab. On *Turritella communis*, *Astarte Danmonia*, and other shells from deep water, Cullereoats (J. A.).

P. (?) MINIATUS, T. Strethill Wright.

ATRACYLIS MINIATA, *T. S. Wright*, Observations on Brit. Zooph., Mier. Journ. (N. S.) iii. 48.

ZOOPHYTE tree-like, branches given off at an acute angle from the stem, crooked, wrinkled, but not ringed, cœnosarc yellow; POLYPITES with 8 alternate tentacles, oral cavity silvery, lining of the stomach bright red-lead colour; REPRODUCTION unknown.

THIS zoophyte forms little “gnarled, shrubby” tufts about an inch high. “The bright-yellow colour of the polypary (cœnosarc) at once strikes the eye, which is also arrested by the gaudy colour of the minute polyps. These appear to be marked by two broad, internal patches,—one corresponding to the buccal cavity, of a dense silvery white; the other to the cavity of the stomach, of a brilliant reddish-orange.” (*Wright*.)

This species can only be placed provisionally until the reproductive bodies have been observed.

Hab. On stones at Largo, exposed at the lowest tides: Granton (T. S. W.).

P. (?) COCCINEUS, T. S. Wright.

ATRACYLIS COCCINEA, *T. S. Wright*, Observations on Brit. Zooph., Ann. N. H. for Aug. 1861, viii. (ser. 3) 130.

STEMS about a quarter of an inch high, of a rich pinkish cream-colour; POLYPITE fusiform, set at an obtuse angle to its stalk, not retractile*, crimson or pink, with 8 alternating tentacles, four long and four short; REPRODUCTION unknown.

THE stems are given off from an open network of milk-

* Sars makes the non-retractility of the polypite one of the characters of his genus *Perigonimus*. But forms, otherwise most nearly allied, differ in this respect; and the character is certainly not of sufficient importance to justify their separation.

white fibres, and bear at their summits a single crimson polypite with transparent, colourless tentacles. "This beautiful little zoophyte, when seen with a single lens, presents a perfect garden of minute animal flowers covering the roots of the seaweed." (*T. S. Wright.*)

Hab. Ineh Garvie, Firth of Forth, on roots of *Laminaria saccharina* (*T. S. W.*).

P. (?) BITENTACULATUS, *T. S. Wright.*

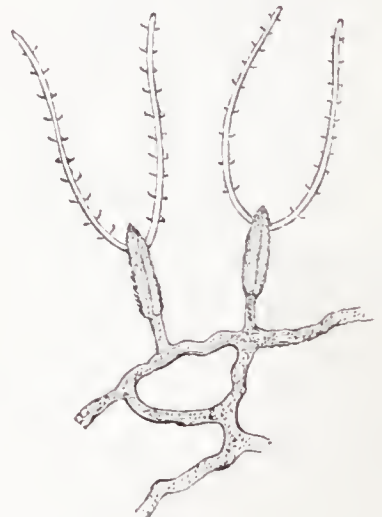
ATRACTYLIS BITENTACULATA, *Wright*, *Journ. Anat. & Physiol.* i. 334, pl. xiv. fig. 5.

STEMS very short; POLYPITES minute, club-shaped, non-retractile, each furnished with two erect tentacles; REPRODUCTION unknown.

THE polypites are thickly clustered on a retiform stolon. "They have the habit, like that of *Lar* (*Gosse*), of quickly and repeatedly bending down the body until the mouth is brought close to the surface on which the zoophyte grows."

Hab. Found in a *Pecten*-shell dredged from the Firth of Forth, near Ineh Keith (*T. S. W.*).

Fig. 9.



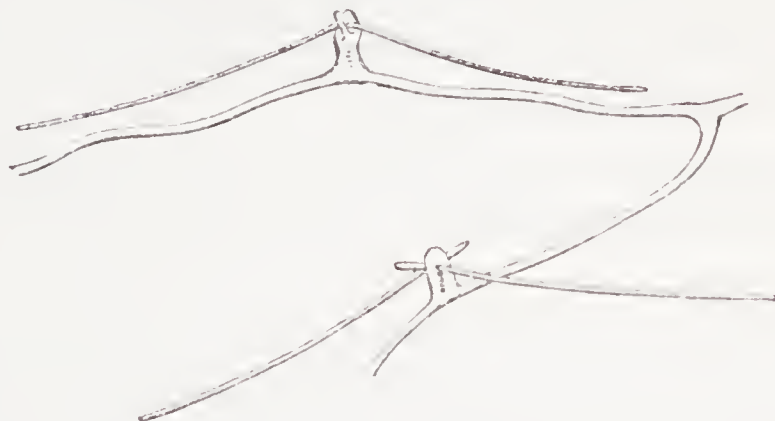
P. (?) QUADRITENTACULATUS, *T. S. Wright.*

ATRACTYLIS QUADRITENTACULATA, *Wright*, *Journ. Anatom. & Physiol.* i. 334, pl. xiv. fig. 6.

POLYPITES sessile, short, columnar, non-retractile, with 4 alternate tentacles—two long and depressed, two very short and nearly at right angles to the body.

THE shorter tentacles were occasionally absent on Dr. Wright's specimen. I cannot but suspect that both the present and the preceding species will prove to be immature forms.

Fig. 10.



Hab. Found ereeping on the side of a vessel of sea-water containing shells and zoophytes dredged from the Firth of Forth (T. S. W.).

Genus HYDRANTHEA, *Hincks*.

Der. From *Hydra*, a genus of Hydroida, and *ἄνθος*, a flower.

GENERIC CHARACTER.—*Stems very short (rudimentary), rising at intervals from a network of anastomosing tubes, the whole invested by a polypary; polypites borne singly on the stems, elongate, fusiform; tentacles filiform, in a single circle surrounding a low conical proboscis, each alternate tentacle bearing a prominent tubercle composed of large bean-shaped thread-cells; gonophores large, borne on peduncles, which spring from the creeping stolon, not invested by the polypary, containing fixed sporosacs.*

IN *Hydranthea* the stem is very slightly developed, and the polypite is not retractile within it. The tentacles are very numerous and surround a somewhat ample disk, in the

centre of which rises a short proboscis. They are held alternately elevated and depressed, and each of the drooping arms bears near its base one of the curious bosses that constitute so striking a feature of this zoophyte. They consist of a number of elongate bean-shaped thread-cells, piled together so as to form silvery-white prominences on the lower side of the tentacles—a girdle of pearls round the base of the tentacular ring.

The gonophores are of great size and are supported on a rather long peduncle, the base of which is invested by the polypary.

They contain a single sporosac, from the bottom of which proceed four much-branched vessels, terminating near the top in blind extremities and immediately enclosing the ova, which fill with a dense mass the interior of the cavity. I have not detected any traces of a manubrium. The *ectotheca*, or outer envelope of the gonophore, is filled with the long bean-shaped thread-cells, which are also present in amazing numbers in the ectoderm of the cœnosare.

H. MARGARICA, Hincks.

ATRACTYLIS MARGARICA, *Hincks*, Ann. N. H. for Jan. 1863, (ser. 3) vol. xi. 45, pl. ix. fig. 4.

Plate XIX. fig. 1.

STEMS invested by small, somewhat funnel-shaped extensions of the polypary; POLYPITES white, with a tinge of yellowish colour on the thickest part of the body, slightly retractile, tapering downwards, swollen in the centre, and expanding towards the upper extremity, with about 30 tentacles, alternately elevated and depressed, and webbed at the base; GONOPHORES produced singly or in pairs close to the polypites, globular, the peduncle tapering downwards and enclosed at the base by a small chitinous cup.

THE polypites, with their numerous tentacles, bear some resemblance to a full-blown flower. The pearly bosses, which are of a lustrous white when seen against a dark ground, are very conspicuous, and form a unique and beautiful garniture. The web connecting the tentacles extends but a short distance above the base.

The gonophores (female), when fully developed, exceed the polypites considerably in size, and contain a very large number of ova. I have counted 300 that had been pressed out of a single sporosac. The branched gastrovascular vessels are orange-coloured.

Hab. Ilfracombe, on *Flustra foliacea* and on this only, in about 7–10 fathoms off the Capstone. The *Flustra* is very abundant in this locality; and almost every bunch that comes up is more or less invested by the *Hydranthea*, which covers it with its delicate network and multitudes of minute polypites.

Genus GARVEIA, T. S. Wright.

Der. Named from Inch Garvie, in the Firth of Forth.

GENERIC CHARACTER.—*Stems compound and branched, rooted by a filiform stolon, the whole invested by a polypary; polypites fusiform, with a single verticil of tentacles, which are not alternately elevated and depressed, surrounding a conical proboscis; gonophores borne on the summit of short branches springing from the stem or the stolon, and containing fixed sporosacs.*

IN this genus the tentacles, contrary to the general rule, are held erect in one uniform series, and not alternately elevated and depressed. The gonophores spring from branches terminating above in a shallow cup, which exactly resemble those that support the polypites.

G. NUTANS, T. S. Wright.

GARVEIA NUTANS, *Wright*, Ed. N. P. Journ. (N. S.) for July 1859, 109, pl. viii. fig. 5.

EUDENDRIUM (CORYTHAMNIUM) BACCIFERUM, *Allman*, Notes on Hydr. Zooph., Ann. N. H. for July 1859.

Plate XIV. fig. 4.

ZOOPHYTE about an inch in height, irregularly branched ; MAIN STEM composed of a few aggregated tubes, becoming gradually attenuated as it gives off its branches, and at last consisting of a simple tube; branches slender, slightly wrinkled, often bent abruptly a little behind the terminal polypite, expanding at the extremity into a delicate funnel-shaped cup; POLYPITES fusiform, the body red, with about 10 thick, orange tentacles; GONOPHORES remarkably large, oval, each borne on a long peduncle, which issues from the summit of a short ramulus,—ova of a deep orange-colour.

IN its perfect state the main stem of this zoophyte is composed of a bundle of delicate tubes, agglutinated together, which diverge at intervals so as to form branches, until at length, towards the extremity, it has dwindled down to a single tube. The polypary is wrinkled transversely (at times almost annulated) throughout. It expands at the extremity of the branches into a cup, which is exceedingly delicate and merely covers the base of the polypite.

The polypites are small and chiefly remarkable for their brilliant colours, the body being red, according to Wright, and the tentacles yellow. The prevailing colour of the zoophyte seems to be orange. Dr. Wright has remarked that, “when irritated, the zoophyte bends all its polyps downwards, like flowers drooping on their stalks”—a circumstance that has suggested the specific name.

The ramules that support the reproductive bodies dilate at their extremities, like the polypiferous branches, into a

cup, from whose centre the long peduncle of the gonophore springs. They occur on the stem and primary branches, and also on the fibrous mat from which the zoophyte rises.

Hab. Inch Garvie (T. S. W.): on rocks, zoophytes, and seaweeds near low-water mark, Firth of Forth (G. J. A.): Shetland (T. H.).

Genus BIMERIA, *T. S. Wright.*

Der. Formed from the name of the Bimer Rock, in the Firth of Forth.

MANICELLA, Allman.

GENERIC CHARACTER.—*Stems branched, rooted by a thread-like stolon, the whole of the cœnosarc enclosed in a chitinous polypary; polypites vase-shaped, with a single verticil of filiform tentacles, the body and the lower part of each tentacle clothed in an opaque-brown membrane; gonophores borne on short ramules developed on the stem and branches, and containing fixed sporosacs.*

B. VESTITA, T. Strethill Wright.

BIMERIA VESTITA, *T. S. Wright*, Edinb. N. P. Journ. (N. S.) for July 1859, 109, pl. viii. fig. 4; *Allman*, Ann. N. H. for May 1864.

MANICELLA FUSCA, *Allman*, Ann. N. H. for July 1859, and August 1859.

Plate XV. fig. 2.

STEM very slender, branched,—the branches alternate, spirally corrugated above their origins, bearing a few short ramules; the polypary of a dull brown colour, covered with minute particles of earthy matter and sand, and continued as a membranous envelope over the body of the polypite and the lower half of the tentacles; POLYPITES with a slightly alternating series of about 16

slender tentacles; GONOPHORES ovate, enveloped by the polypary, borne on the summit of short branches, which are wrinkled spirally.

WE have two independent accounts of this zoophyte, from Wright and Allman, who discovered it about the same time. For I have little doubt of the identity of the *Bimeria vestita* and the *Manicella fusca* of these authors, although the former is described by Wright as destitute of a proboscis, while the latter, according to Allman, has this organ well-developed. The proboscis amongst the Hydroids is constantly changing its form and assuming the most different appearances, being sometimes extremely prominent, and at others so much contracted as to be scarcely visible. As the two zoophytes perfectly agree in other characters, it is probable that this slight discrepancy between the descriptions merely points to a difference in the condition of the specimens examined.

The polypary of *Bimeria*, when divested of its earthy coating, is transparent and of delicate texture. The whole habit of the zoophyte is slender, the branching is very regular, and there is no expansion towards the terminal aperture. The most marked character is the membranous envelope, or extension of the polypary, which involves the body of the polypite and forms a rather thick sheath round the lower portion of the tentacles. Dr. Wright has remarked that the unclothed half only of the arms is furnished with thread-cells.

Hab. On the Bimer Rock, near North Queensferry, and on Inch Garvie, Firth of Forth (T. S. W.): Firth of Forth, "attached to other zoophytes and seaweeds near low water, spring tides" (G. J. A.): Whitby, Yorkshire; Torbay and Salcombe, South Devon, dredged on other zoophytes, not uncommon (T. H.).

Genus DICORYNE, *Allman*.

Der. From δis , double, and $\kappa\omicron\pi\acute{o}\upsilon\eta$, a club.

GENERIC CHARACTER.—*Stem branched or simple, rising from a creeping, filiform, and anastomosing stolon, the whole invested by a polypary; polypites (alimentary) fusiform, with a single verticil of filiform tentacula round the base of a conical proboscis; gonophores borne on rudimentary polypites, destitute of tentacles, which are developed on the stems or on the creeping stolon; gonozooid natatory, ciliated over its entire surface, and having two filiform tentacles diverging from the posterior end.*

D. CONFERTA, Alder.

EUDENDRIUM (?) CONFERTUM*, *Alder*, Durh. & North. Cat. in Trans. Tynes. Nat. F. C. iii. 103, pl. i. figs. 5–8.

DICORYNE STRICTA, *Allman*, Ann. N. H. (3rd ser.) iv. 370.

DICORYNE CONFERTA, *Allman*, Ann. N. H. (3rd ser.) viii. 168; *Alder*, Supp. to North. Cat., Trans. Tynes. N. F. C. v. 228, pl. viii. figs. 1, 2.

Plate XVIII. fig. 1.

STEM simple or irregularly branched, the branches erect; polypary of a light brown colour, strongly annulated across, slightly dilated and everted at the extremities of the branches; ALIMENTARY POLYPITES rather large, fusiform, white or pale flesh-coloured, with a verticil of about 16 tentacles; FERTILE POLYPITES slender, fusiform, covered with thread-cells above, and bearing the gonophores in clusters round their base; GONOPHORES oval, shortly stalked.

GONOOID oval, pointed at one end, expanded and truncated at the other, from which the two long tentacles diverge.

* Mr. Alder identifies with this species the *Tubularia* described by Johnston in the 'Trans. of the N. H. Soc. of Northumb., Durh., and Newcastle-on-Tyne,' ii. 253.

DICORYNE CONFERTA grows in dense masses on old univalve shells. Its principal shoots rise to a height of about half an inch and are irregularly branched. The branches are erect, "ascending at a very acute angle from the stem," so that the habit is slender and compact. Besides the taller shoots, there are generally many short, unbranched stems, bearing single polypites. These are chiefly of the proliferous kind; and I have seen a large portion of the surface of the shell, over which the zoophyte was spreading, densely covered with a multitude of them, heavily laden with the clustering fruit. The fertile are also mingled with the alimentary polypites on the larger shoots; but in the specimen to which I have referred, the latter formed an inconsiderable element, compared with the thick undergrowth that surrounded them.

The number of the tentacles is variable. It sometimes reaches 16, but Alder gives 10 as the usual complement.

The remarkable free zooid of the *Dicoryne* is unique, so far as our present knowledge goes, and is extremely interesting as an intermediate form. It consists of a sexual polypite (manubrium) furnished with two tentacles, which represent the more usual natatory organ, while simple ciliary action replaces the propulsive movement of the swimming-bell. It swims, according to Allman, "with its body in a vertical position, carrying the posterior or tentacular extremity uppermost, and maintaining all the time a constant rotation on its longer or vertical axis." The female zooid produces two ova.

Hab. On old shells of *Buccinum undatum* and *Fusus antiquus* from deep water, Cullercoats (J. A.): Orkney, in about 3 fathoms, on an old *Buccinum undatum* tenanted by a Hermit Crab (G. J. A.): Shetland, on *Turritella* &c. (A. M. N.).

Genus HETEROCORDYLE, *Allman*.

Der. From ἕτερος, dissimilar, and κορδύλη, a club.

GENERIC CHARACTER.—*Stems simple or branched, rising from a creeping filiform and anastomosing stolon, the whole invested by a polypary; polypites fusiform, with a single verticil of filiform tentacula round the base of a conical proboscis; gonophores borne on rudimentary polypites, destitute of tentacles, developed directly from the creeping stolon, containing fixed sporosacs.*

H. CONYBEAREI, *Allman*.

Ann. Nat. Hist. for July 1864, (3rd ser.) xiv. 59, pl. ii.

Plate XVIII. fig. 2.

STEMS branched or simple, crowded on the creeping stolon, the longest attaining a height of about 4 lines; polypary transversely corrugated, slightly dilated at the base of the polypites, ash-brown; POLYPITES with about 12 tentacles, alternately erect and depressed, presenting a slightly clavate outline at their extremities; GONOPHORES borne on erect, club-shaped shoots, thickly set with thread-cells above, which spring out of a short tubular process from the surface of the creeping stolon, with very short peduncles, densely crowded, commencing a little behind the upper extremity of the shoot and extending to within a short distance of its base.

THIS species closely resembles, in general appearance, *Dicoryne conferta*; but it is of humbler growth and somewhat stiffer habit, and is further and chiefly distinguished by its simple, fixed sporosacs.

Hab. The Harbour of Glengariff, co. Cork, on old univalve shells tenanted by Hermit Crabs (G. J. A.): Oban, on *Buccinum*, near low-water mark (T. H.).

Genus BOUGAINVILLIA, *Lesson*.

Der. Named after a distinguished French voyager, Admiral Bougainville.

HIPPOCRENE, Mertens, Mém. Acad. St. Pétersbourg, 1835, 229.

MARGELIS, Steenstrup, Vidensk. Medel. for 1849-50, 43.

GENERIC CHARACTER.—*Stem branched, rooted by a filiform stolon, the whole cœnosarc invested by a polypary; polypites fusiform, with a single wreath of filiform tentacles round the base of a conical proboscis; gonophores developed from the branches and originating free zooids.*

Gonozoid: Umbrella (at the time of liberation) deep bell-shaped; manubrium shorter than the bell, with 4 oral tentacles; radiating canals 4; marginal tentacles 8, borne in pairs on bulbs at the termination of the canals, with an ocellus at the base of each.

As the zooid advances towards maturity the tentacles of the manubrium become branched, and those on the marginal bulbs increase considerably in number.

It is a curious fact, and one that strikingly illustrates the difficulty attendant upon the classification of the Hydroida, that the sexual zooid of *Corynopsis*, one of the *Podocorynidæ*, is identical with that of the present genus, at least in its earliest stage.

The *Margelis* of Steenstrup has been adopted by Agassiz for the members of Lesson's genus *Bougainvillia*, which have "a long, slender digestive cavity, with but slightly branching tentacles." But the differences between the two sections, which are confined to the reproductive element, seem to me to be of slight significance, and quite insufficient to justify the dismemberment of a group that exhibits in its leading features so definite a type of structure.

1. B. RAMOSA, Van Beneden.

EUDENDRIUM RAMOSUM, *Van Ben.*, Rech. sur les Tubul. 56, pl. iv. (with the exception of fig. 2).

TUBULARIA RAMOSA, *Dalyell*, Rem. An. Scotl. i. 64, pl. xi.

MEDUSA OCILIA and DUODECILIA (the free zooid), *Daly.* ibid. 66 & 72, pl. xi.

ATRACTYLIS RAMOSA, *T. S. Wright*, Edinb. New Phil. Journ. (N. S.) for Jan. 1859, vol. viii. pl. i. figs. 1, 2, 3.

MARGELIS RAMOSA, *Agassiz*, N. H. U. S. iv. 344.

BOUGAINVILLIA RAMOSA, *Allman*, Ann. N. H. for May 1864.

Plate XIX. fig. 2.

ZOOPHYTE *much branched*, of a yellowish horn-colour; MAIN STEMS and larger branches thick, composed of many delicate tubes; *the branches alternate and somewhat spirally disposed, bearing numerous short ramules, which dilate at the extremity into a kind of cup, within which the polypite is in great part retractile*; POLYPITES with nearly 20 white tentacles when adult; GONOPHORES *borne in pairs or clusters on the ramules, a little below the cup-like expansion*, pyriform, pedunculate, invested by a delicate capsule, and containing a single zooid.

GONOOID.—UMBRELLA (at the time of liberation) deep bell-shaped, without thread-cells; MANUBRIUM of an orange colour, with simple oral tentacles, which carry capitate clusters of thread-cells at the extremity; MARGINAL TENTACLES with orange bulbs and a dark ocellus at the base of each.

WHEN finely grown, *B. ramosa* attains a height of 3 inches, and presents a very tree-like appearance. In large specimens the main stem is very thick and coarse, and the branching luxuriant and irregular. The habit, as noted by Mr. Alder, is not unlike that of *Halecium*. The lower and larger branches are compound, like the stem, and often much ramified. The polypiferous ramules are short, and terminate in a very decided cup, within which the polypite is almost concealed when retracted. This cup is

very frail, and soon disappears after the death of the polypite.

The gonozooids, which are produced in great numbers, undergo remarkable changes after their liberation. These consist in the development of additional tentacles and ocelli on the marginal bulbs, until the number reaches 6 or 8 in each cluster, and in the dichotomous division and subdivision of the oral appendages. When fully matured, they are probably identical with the *B. Britannica* of Forbes's monograph.

The changes in the zooid subsequent to its detachment have been observed by Wright in this species, and by A. Agassiz in the American *B. superciliaris*. We learn from the latter author that the second sets of tentacles are "developed in pairs, one tentacle on each side of those of the first set," and the development proceeds in this order until the number is complete.

In its first stage the gonozooid of *B. ramosa* is the *Medusa ocilia* of Dalyell.

Hab. On shells and stones and on other zoophytes: Scotland, on *Virgularia mirabilis* (Dalyell): Queensferry, Firth of Forth (T. S. Wright): Oban Bay, in about 15 fathoms, very fine; dredged in Torbay (T. H.): from the deep-water fishing-boats, Northumberland, fine (J. A.).

[Ostend, Van Ben.]

2. *B. FRUTICOSA*, Allman.

BOUGAINVILLIA FRUTICOSA, Allman, Notes on the Hydroida, Ann. N. H. for July 1864.

EUDENDRIUM RAMOSUM, Allman, Proc. Roy. Soc. Ed. Dec. 6th, 1858.

ZOOPHYTE rising to the height of about 2 inches, much branched; MAIN STEMS composed of aggregated tubes; branches subalternate, the polypary of the smaller branches slightly corrugated transversely; POLYPITES

in extreme extension nearly cylindrical, protected at the base by a membranous corrugated cup, into which about a third of the body is withdrawn when contracted; GONOPHORES pyriform, on distinct peduncles, invested by a delicate chitinous capsule, *springing from the upper-side of the ramules, along which they range almost from end to end.*

GONOOZOID.—UMBRELLA (at the time of liberation) deep bell-shaped, with a well-developed velum, measuring about $\frac{1}{20}$ inch across its base; MANUBRIUM subcylindrical, somewhat dilated at its base, of moderate size; RADIATING CANALS terminating in bulbs, containing red pigment-granules, at the root of every tentacle a black eye-speck.

THE foregoing description is based on Prof. Allman's papers. I have not had the opportunity of examining this species, which differs very slightly from the *B. ramosa*.

The following are the distinctive points:—The polypite of *B. fruticosa* when extended is of a more cylindrical and slender form; the membranous cup is smaller, covering only about one-third of the body, whereas in *B. ramosa* it almost entirely conceals the polypite during extreme contraction; and the reproductive buds are borne along the whole of the upper surface of the ramules, instead of occurring in pairs or small groups a little behind the free extremity. The gonozooids of the two forms seem to be identical.

Hab. Growing in abundance on a piece of floating timber in the mouth of the Kenmare River, co. Kerry (G. J. A.).

3. *B. MUSCUS*, Allman.

PERIGONIMUS MUSCUS, *Allman*, Ann. N. H. for Jan. 1863.

BOUGAINVILLIA MUSCUS, *Allman*, Ann. N. H. for May 1864.

STEMS *about half an inch in height, simple, springing at in-*

Intervals from the ereeping stolon, and *sending off short branches, which are for the most part without further ramification*; POLYPARY light brown, slightly corrugated, with a well-marked cup-like dilatation at the base of the polypite; POLYPITES light reddish brown, with about 16 tentacula held, in extension, alternately elevated and depressed; GONOPHORES borne on a rather long peduncle, and springing from the branches a little behind the polypite.

GONOOZOID.—UMBRELLA (at the time of liberation) dome-shaped; MANUBRIUM extending to about a third of the depth of the umbrella.

THE free zooid is in all points undistinguishable from that of *B. ramosa*. The present species is known by its "small size and general habit, its more simple ramification, and the fact that its stems consist of a single tube, instead of being composed of numerous tubes coalesced into a dense bundle." (*Allman*.)

Hab. In a rock-pool, Torquay, where it occurred abundantly, creeping over the bottom in small moss-like tufts (J. G. A.).

I have met with a form in various localities which is somewhat intermediate between this species and *B. ramosa* (Plate XIX. fig. 3). It is of small size, not exceeding an inch in height; the main stem is compound towards the base, but still slender as compared with that of the latter species. The ramification is simple, the branchlets being regularly alternate and approximate. The colour is a light yellowish brown, and the polypary has the appearance of being sanded over. The main branches are less distant than in *B. ramosa* and are not compound, and the whole habit is simpler and more delicate. The composite portion of the stem is slender, and does not extend far. It is made up of very delicate tubules.

Long fusiform bodies, supported on separate ramuli,

are commonly met with on this variety, the significance of which I have not determined with certainty, but which are probably the nests of some parasitic larva, such as has been observed on *Hydractinia* and *Syncoryne*. Van Beneden has represented a similar structure on a zoophyte which he refers to his *Eudendrium ramosum* (Mém. sur les Tubulaires, pl. iv. fig. 2), but which, judging from his figure of the gonophores, must be a distinct species (woodcut, fig. 11). Possibly this may be identical with

Fig. 11.



my variety, which I have never found with its reproductive bodies. This point must be left for future settlement.

Family XI.—Tubulariidæ.

POLYPITES *flask-shaped, with two sets of filiform tentacula, one oral, the other placed near the base of the body.*

Genus TUBULARIA, *Linnæus* (in part).

Der. From *tubulus*, a little tube.

PARYPIA, Agassiz, N. H. U. S. iv. 342 (for some of the species).

THAMNOCNIDIA, Agassiz, N. H. U. S. iv. 342 (ditto).

GENERIC CHARACTER.—*Stems simple or branched, rooted by a filiform stolon, the whole invested by a polypary; polypites flask-shaped, with filiform tentacles disposed in two verticils—the oral short and surrounding a conical proboscis, the aboral long and forming a circle near the base of the body; gonophores borne on peduncles springing from the body of the polypite between the two circles of tentacles, containing fixed sporosacs.*

THE polypites of this genus are richly coloured with various shades of red, and present the appearance of bright flowers on erect and slender stems.

The reproductive buds never become detached; but in some cases (e. g. *T. indivisa*) they are furnished with an umbrella in which the radiating and circular canals are present, and an orifice surrounded by four tubercles, representing the marginal tentacles. The manubrium is destitute of a mouth. There is every preparation for independent existence up to a certain point; but here an arrest of development takes place, and the bud remains enclosed in the outer envelope, while the swimming-bell is converted into a chamber or nursery, in which the embryo passes through its early stages, escaping at last through the opening above. In the development of *Tubularia* the planule stage is ab-

sent, and the young, on issuing from the ovisac, has already assumed the polypite form. A verticil of long arms surrounds the base of the proboscis; and the oral series is either present in a rudimentary condition or subsequently developed (Plate XX. fig. *b, b*). The embryo walks about by means of its arms, like a cuttlefish, with its head downwards*. After a time it attaches itself by its base, and the stem is gradually developed.

We meet with a similar mode of reproduction in a member of the genus *Coryne* (*C. VanBenedenii*) and also in *Myriothele*.

The polypites of *Tubularia*, at least when kept in captivity, are shed at short intervals, but are soon renewed. The prolific pulp gives origin to a succession of generations; and the birth of each is registered by the formation of a ring on the polypary.

1. *T. INDIVISA*, Linnæus.

"TUBULAR CORALLINE, LIKE OATEN PIPES," *Ellis*, Corall. 31, t. xvi. fig. 6.

TUBULARIA INDIVISA, *Linn.* Syst. 1301; *Lamk.* An. s. Vert. (2nd ed.) ii. 125; *Lamx.* Exp. Méth. 17; *Dalyell*, Rem. An. Scotl. i. 2, pl. i. ii. iii. & iv.; *Lister*, Phil. Trans. 1834, 366, pl. viii. fig. 1; *Johnst.* B. Z. 48, pl. iii. figs. 1, 2; *Mummery*, Q. J. Microscop. Se. for 1853, 28; *T. S. Wright*, Ed. N. P. Journ. (N. S.) for Jan. 1858, 113, pl. iii. figs. 2, 3; *Allman*, Ann. N. II. for July 1859.

„ CALAMARIS, *Pall.* Elench. 81; *Ehrenb.* Corall. roth. Meer. 71.

(?) TUBULARIA GIGANTEA, *Lamx.* Expos. 17, t. lxviii. fig. 5.

Plate XX.

STEMS *clustered, simple, erect, without annulation, narrowed*

* Van Beneden's statement respecting the young of *T. coronata*, "elle n'a aucun moyen de locomotion," is incorrect. The tentacles are employed as feet. They are also used as oars, by means of which it moves freely through the water; and in more than one case probably the floating Tubularian embryo has been taken for a new generic form.

and twisted at the base, horn-coloured, rising to a height of from 6 to 12 inches; POLYPITES deep red; oral tentacles short and very numerous, aboral long, white, tapering, about 40 in the adult; GONOPHORES on branched peduncles, forming large and very numerous clusters, springing from the base of the lower tentacles; SPOROSACS with four radiating canals and four small tubercles at their terminations.

THE habit of *T. indivisa* is eminently simple, though occasionally the stems divide slightly towards the lower part. At the base the tubes are much twisted and interwoven, and are often agglutinated together for some distance above it.

The embryos on exclusion from the ovisac not unfrequently fix themselves on the stems, and develop themselves in this position, so as to give the appearance of branching. I have seen whole colonies of young of all ages grouped on the older stems.

The gonophores are developed in great profusion, and the clusters attain a large size, hanging down on all sides like bunches of fruit. The sporosac exhibits in great part the structure which is characteristic of the free sexual zooid, but continues permanently attached. At the upper extremity there is a somewhat square opening, with four red spots on the margin, marking the termination of the radiating canals. The spadix is red and conspicuous. When the embryo issues from the ovisac it has twelve of the long arms, and the oral series is just sprouting.

The stem in *T. indivisa* is traversed by a system of longitudinal canals in which the circulation of the nutrient fluid takes place; these are arranged in a circle immediately within the outer wall of the cœnosarc, the central portion being imperforate. They are ciliated on the in-

terior surface, and terminate above in a single cavity at the base of the lower tentacular verticil*.

This beautiful zoophyte has a wide range bathymetrically, being found on rocks between tide-marks, and in shallow water near shore, and also at great depths (140 fathoms, off the Mull of Galloway, *Beechey*).

The *T. gigantea* of Lamouroux, which reaches a height of from 12 to 15 inches, was referred by Dr. Johnston to the present species; but Mr. Alder, who obtained it on the Northumberland coast, was of opinion that it might prove distinct, and certainly required further examination.

Hab. On rocks between tide-marks and in shallow water, and on shells, stones, &c. from deep water: common and generally distributed.

It often covers profusely the sides of rocks and the under surface of ledges a little above low-water mark, hanging from them in unsightly tufts when the tide is out, but rising into sudden beauty with the return of the water, and clothing them with all the gaiety of a garden. On the pontoons of the great landing-stage at Liverpool it must grow in wonderful luxuriance, and present a rare spectacle of zoophytic beauty. I shall not soon forget the *bucketful* of this zoophyte, in the finest condition, which Mr. Moore, the able Curator of the Free Museum in that town, procured for me from this locality.

Dr. Collingwood informs me that in February he has taken specimens from the landing-stage "having pendent clusters of ova two inches long." In summer, he adds, this zoophyte "appears to offer a favourite feeding-ground for *Dendronotus arborescens*." The Dingle rocks, also in the Mersey near Liverpool, are covered, as I learn from the same gentleman, at low-water mark and below it, with

* Dr. T. S. Wright, "Observations on Brit. Zooph.," Ed. N. P. Journ. (N. S.) for Jan. 1858; Agassiz, N. H. U. S. vol. iv. 267.

a luxuriant growth of *T. indivisa*. "After a storm," he writes, "I have seen this spot looking like a stubble-field, the heads all gone, and the straw-like tubes only left."

Lieut. Thomas tells us, in the valuable notes which are published in the Supplement to Johnston's 'History,' that "on the oozy bottom which lies outside a line drawn between Flamborough Head and the Staples" it grows to a very large size. Prof. Forbes found it in Rothsay Bay, flourishing, as it seemed, "upright on a muddy ground like a flower, fixed by the tapering root-like termination of its horny case." In Cornwall, according to Couch, it ranges in height from 2 to 14 inches. Dr. Pereeval Wright has found it in remarkable beauty off the west coast of Ireland. Guernsey (A. M. N.).

[Tromsö and the North Cape in 30 fathoms, and Bergen (Sars): Greenland (Möreh): Bay of Biscay (Beltremieux).]

2. *T. LARYNX*, Ellis and Solander.

"TUBULOUS CORALLINE WRINKLED LIKE THE WINDPIPE," *Ellis*, Corall. 30, t. xvi. fig. b.

TUBULARIA MUSCOIDES, *Pallas* (not. *Linn.*), Elench. 82.

„ LARYNX, *Ellis and Solander*, 31; *Lamk.* An. s. V. (2nd ed.) 126; *Johnst.* B. Z. 51, pl. iii. fig. 3, and pl. v. figs. 3, 4; *Dalyell*, Rem. An. Scotl. i. 42, pl. v.

EUDENDRIUM BRYOIDES, *Ehrenb.* Cor. roth. Meer. 72.

Plate XXI. fig. 1.

STEMS clustered, simple or slightly branched, slender, pellucid, pale horn-coloured, ringed at pretty regular intervals; POLYPITES small, light red, with white tentacles; GONOPHORES clustered on short peduncles, oval, of a purplish-red colour.

Height from $\frac{1}{2}$ an inch to $1\frac{1}{2}$ inch.

T. LARYNX is of humble growth, much smaller than the next species, and more regularly ringed. Annulated spaces

occur at intervals throughout the length of its stems, which are of very thin papyraceous texture. It is sometimes simple, but often irregularly and fantastically branched, the branches being short and given off at various angles. The polypite is very small in comparison with that of *T. coronata*, but brilliant as others of its tribe, "equal in richness of colour to the Guernsey Lily," according to Ellis; and the gonophores are borne in shortly stalked clusters.

The tubes of *T. larynx* are on the whole less slender than those of *T. coronata*, but its delicate little tufts contrast strongly with the tall complicated masses of the latter species.

Hab. Common between tide-marks, and ranging to deep water. "Near the opening of the Thames, adhering to other marine bodies and often to the bottoms of ships" (Ellis): from brackish water to 50 fathoms, on the east coast, Scotland (Lieut. Thomas): on stones between tide-marks, South Devon, common (T. H.): Belfast Lough (W. Thompson): &c. &c.

[Mediterranean (Pallas): Mouth of the Elbe (Kirchenpauer); Grand Manan (Stimpson).]

3. *T. CORONATA*, Abildgaard.

TUBULARIA CORONATA, *Abildgaard*, Zool. Dan. (*Müller*), iv. 25, pl. exli. figs.

1-5; *Van Beneden*, Mémoire sur les Tubul. 49, pl. i. figs. 7-19;

Allman, Proc. Roy. Soc. Edinb. Session 1857-58.

„ LARYNX, var. β , *Johnston*, B. Z. (1st. edit.) 116.

„ GRACILIS, *Harvey*, Proc. Zool. Soc. no. xli. 54; *Johnston*, B. Z. (2nd edit.) 52, pl. iv. figs. 3-5; *Alder*, North. and Durh. Cat. in Trans. Tynes. F. C. iii. 107.

Plate XXI. fig. 2.

STEMS clustered, very slender, irregularly branched, of a light straw-colour, smooth or somewhat wrinkled, with occasional ringed spaces; POLYPITES large, bright orange-

red; GONOPHORES *on much-branched peduncles, forming large clusters, oval, with 4 small tubercles at the upper extremity when mature.*

Height 3 to 3½ inches.

THIS species grows in complicated masses formed of very slender, light-coloured, interlacing tubes. The stems are often much and irregularly branched, especially towards the lower extremity. They are for the most part perfectly smooth; but here and there a few distinct annulations occur, and there is sometimes a good deal of obscure wrinkling. The polypites are large and handsome, and the long branched clusters of gonophores with their red centres form a conspicuous feature.

This species has been fully investigated by Van Beneden*. He states that the young, on exclusion from the gonophore, has usually twelve long arms, but he has observed as few as six. The oral tentacles, in the cases that came under his observation, were not developed until some time after the embryo had made its escape. It appears, however, from the observations of Sars, that they are sometimes present in a rudimentary state at the period of liberation. Indeed the embryos seem to be excluded in very various stages of development. The gonophores contain simple sporosacs with four inconspicuous tubercles at the summit.

The *T. gracilis* of Harvey is probably identical with the present species; but his description leaves some room for doubt.

Hab. Generally in deep water. Shetland (J. G. Jeffreys): Northumberland, "on corallines and other marine substances, generally on a muddy bottom, in the coralline zone and deep water" (J. A.): Lytham, Lancashire, in great profusion, cast ashore in large compact masses (T. H.).

* Faune littor. de Belgique, Polypes, 1866, p. 110, pl. iv.

[Belgium (Van. Ben.): mouth of the Elbe (Kirehenpauer): Denmark (Abildgaard): Sars records the occurrence of a *Tubularia* at Messina under the name of *T. larynx*, which he identifies with the *T. coronata* of Van Beneden. He states that the same species is common in the North Sea.]

4. *T. SIMPLEX*, Alder.

TUBULARIA DUMORTIERII, *Johnst.* B. Z. 50; *Alder*, Trans. Tynes. F. C. iii. 106.
 ,, SIMPLEX, *Alder*, Supp. North. Cat. in Trans. Tynes. F. C. v. 232,
 pl. viii. figs. 3, 4.

Plate XXII. fig. 1.

STEM slender, smooth, unbranched, *without annulations, generally a little angulated at intervals* and tapering towards the bottom, horn-coloured, *usually solitary and attached by a short creeping base*; POLYPITE slender, rose-coloured; tentacles whitish, the oral biserial, shorter and less numerous than in *T. indivisa*; the aboral 20–24, moderately long.

Height 2 to $2\frac{1}{2}$ inches.

THE tubes of this species are exceedingly slender, and the angulation seems to be a pretty constant character. The smaller size and the solitary habit distinguish it from *T. indivisa*. When living, the stems appear orange or scarlet, from the contained cœnosarc.

Dr. Johnston has given a very accurate description of this form, but referred it to the *T. Dumortierii* of Van Beneden, from which it differs widely. He says that the gonophores are spherical and shortly stalked.

Hab. On shells and other marine bodies from deep water, Cullerecoat (J. A.): Berwick Bay (Dr. Johnston): Oban, on stone (T. H.).

5. *T. BELLIS*, Allman.

"Notes on the Hydroida," Ann. N. H. for January 1863.

Plate XXI. fig. 3.

STEMS *short, sparingly branched*, from $\frac{3}{4}$ to 1 inch in height, *pretty regularly marked by distinct annulations, which extend to the creeping stolon*; CÆNOSARC orange, deepening in tint towards the base, expanding into a collar immediately below the polypites; POLYPITE *very large*, measuring, in full-sized specimens, about 5 lines from tip to tip of the extended tentacles, body scarlet; GONOPHORES *oval, on short, erect, branched peduncles; each gonosac with 4 well-marked tentaculoid tubercles on its summit*; the peduncles and spadix scarlet.

"A BEAUTIFUL little zoophyte, conspicuous by the bright colour and large size of its polypes." (*Allman*). The annulation, which extends pretty uniformly throughout the stem, is remarkably well-defined.

Hab. "Attached to the bottom of rock-pools at extreme low-water spring-tides, Shetland" (G. J. A.).

6. *T. ATTENUATA*, Allman.

"Notes on the Hydroida," Ann. N. H. for July 1864.

STEM 3 or 4 inches high, *slender, obscurely corrugated, of a light straw-colour, very irregularly branched, with the branches given off at a wide angle*; POLYPITE supported on a collar-like expansion of the cœnosarc, the oral tentacles about one-third as long as the aboral, the body deep vermilion between the two tentacular verticils, and thence becoming paler towards the enlarged base; GONOPHORES (*male*) *on short, erect, branched peduncles, usually 5-8 in a cluster; tentacular appendages long*.

"*T. ATTENUATA* is a deep-water species. * * * It differs

from *T. coronata* chiefly in its more diffuse habit and the short erect peduncles of its clusters of gonophores; while from the *T. simplex* of Alder it is easily distinguished by its branched hydrocaulus [stem] and the greater length of its distal [oral] tentacles." (*Allman.*)

Hab. Firth of Forth, from about 15 fathoms; Shetland seas, from about 50 fathoms (G. J. A.).

7. *T. HUMILIS*, Allman.

"Notes on the Hydroida," Ann. N. H. for July 1864.

STEMS about 1 inch high, simple or sparingly branched, springing at distinct intervals from the stolon; POLYPARY *light yellow, with nearly obsolete transverse corrugations*; POLYPITES *rather small, scarlet, supported on collar-like expansions of the cœnosarc*; oral tentacles about 15, aboral 20; GONOPHORES (male) *borne on very short branching peduncles, and forming erect scarlet clusters*, usually about three in each cluster; *summit of gonosac with three rather large tentaculiform tubercles.*

"It resembles *T. bellis* in its mode of growth and in the shortness of its hydrocaulus [stem], but is at once distinguished from this species by the absence of distinct annulation, and by the smaller size and less appressed form of the polypite." (*Allman.*)

Hab. "On rocks close to the level of low-water spring-tides, near the mouth of Kinsale Harbour" (G. J. A.).

Genus ECTOPLEURA, *Agassiz.*

Der. ἐκτὸς, without (outside), and πλευρά, a rib.

TUBULARIA (in part).

GENERIC CHARACTER.—*Stems fistular, simple or branched,*

rooted by a filiform stolon, the whole clothed by a polypary ; polypites flask-shaped, with filiform tentacles in two verticils—the oral short, surrounding a conical proboscis, the aboral long, near the base of the body ; gonophores developed in clusters on the body of the polypite between the circles of tentacles, containing free medusiform zooids.

Gonozooid : Umbrella (at the time of liberation) nearly spherical (slightly flattened at the two poles), traversed by prominent longitudinal ribs formed of series of thread-cells ; manubrium with a simple mouth, shorter than the bell ; radiating canals 4 ; marginal tentacles 4, without ocelli at the base.

E. DUMORTIERII, Van Beneden.

TUBULARIA DUMORTIERII, *Van Beneden*, Mém. sur les Tubul. 50, pl. ii. ; *Johnston*, B. Z. pl. vii. figs. 1, 2 (not the species described in the text).

ECTOPLEURA DUMORTIERII, *Agassiz*, N. H. U. S. iv. 342.

Plate XXI. fig. 4.

STEMS about half an inch in height, scattered, simple (or occasionally very slightly branched), slender, of a pale horn-colour, attenuated and annulated at the base ; POLYPITES proportionally large, rose-coloured ; oral tentacles short, in two series, numbering about 24 ; lower tentacles about 30, of moderate length ; GONOPHORES spherical, borne on short, branched peduncles.

GONOOZOID.—UMBRELLA (at the time of liberation) melon-shaped, traversed by eight longitudinal ribs ; MANUBRIUM reddish ; MARGINAL TENTACLES set at intervals with clusters of thread-cells.

THE *Tubularia Dumortierii* of Johnston is not the zoophyte that had been previously described by Van Beneden under this name, but another species, which has been distinguished and characterized by Alder as *T. simplex*.

Prof. Wyville Thomson has recorded the occurrence of

the Belgian zoophyte in Belfast Bay ; but specimens of the dried polypary from this locality, which he has kindly sent me, are much stouter and of coarser texture than any examples I have seen of *E. Dumortierii*, and, I believe, must be referred to some other species. A single stem with its polypite, attached to a piece of drift-wood which I obtained in the Isle of Man, east ashore on the magnificent shingle-beach at the Point of Ayr, is the only British specimen that I know of. I have had the opportunity of comparing it with specimens of *E. Dumortierii* supplied by Van Beneden, and have assured myself of their identity.

The present form is of small size and great delicacy of habit, and the stems are developed singly and not in clusters. The polypary is of a light yellowish horn-colour and transparent. It is slightly annulated towards the base of the stem, which, in my specimen, tapers off very finely, and is attached to a short ereeping fibre ; indeed the tube gradually expands upwards from the point of attachment to the terminal aperture. Here and there in the course of the stem there occurs a more or less perfect ring.

The polypite is large for so diminutive and delicate a species, and, like most of the tribe, is of a reddish colour.

Hab. On drift-wood east ashore at the Point of Ayr, Isle of Man (T. H.).

[Ostend, abundant on *Flustra*, the earapace of erabs, &c. (Van Beneden).]

Genus CORYMORPHA, Sars (in part).

Der. *κορύνη* (*Coryne*), a club, and *μορφή*, form.

GENERIC CHARACTER.—*Polypite solitary, borne on a simple stem, which terminates in a conical base and is invested*

by a delicate membranous sheath; flask-shaped, with two sets of filiform tentacles—the oral short, in several verticils placed close together and surrounding a prominent proboscis, the aboral longer, in a single series near the base of the body; gonozooids on branched peduncles, borne on the body of the polypite at the base of the lower tentacles, free and medusiform when mature.

Gonozooid: *Umbrella* (at the time of liberation) nearly globular; manubrium with a simple mouth; radiating canals 4, terminating in four marginal bulbs, from one of which, in some cases, a single tentacle is developed, while in others each bulb bears a tentacle.

THE *Steenstrupia* of Forbes is founded on the free zooid of this genus.

Corymorpha is distinguished by a number of remarkable characters. Its solitary habit it shares with only two Hydroid genera beside (*Myriothela* and *Hydra*). The membranous sheath which invests the eœnosarc is a modification of the more usual polypary; while the free basal extremity, with its appendages, adapted to root the zoophyte in the sand, is a unique peculiarity. The gonozooids, like those of *Clavatella*, are not contained in a protective sac (cetotheca), but are naked throughout the course of their development.

Schmidt has constituted the genus *Amalthæa* for two or three species in which each of the four bulbs on the margin of the umbrella gives origin to a fully developed tentacle. In all other points they seem to agree with Sars's genus *Corymorpha*; and I cannot allow that a mere difference in the number of arms, unaecompanied by any other structural peculiarity, is a sufficient ground for detaching them from it. I have therefore made the diagnosis of the present genus broad enough to include them.

1. C. NUTANS, Sars.

CORYMORPHA NUTANS, Sars, 'Beskrivelser' &c. 7, pl. i. fig. 3; *Forbes & Goodsir*, Ann. N. H. for 1840, (1st ser.) v. 310; *Johnston*, B. Z. 54, pl. vii. figs. 3-6; *Hodge*, Trans. Tynes. F. C. v. 80, pl. ii. figs. 1-10; *Allman*, Ann. N. H. for January 1863.

Plate XXII. fig. 2.

STEM subcylindrical, *tapering slightly upwards, and enlarging at a short distance above the blunt, conical base, of a pinkish colour, traversed by reddish-brown longitudinal lines*; POLYPARY a transparent membranous tube; POLYPITE of a pink colour; *oral tentacles very numerous (about 80), delicate, very contractile, arranged in several alternate series; aboral tentacles about 30, white, long, and tapering.*

GONOOIDS *naked, borne in clusters on the extremities of the branched stalks*; UMBRELLA (at the time of liberation) almost globular, slightly narrowed towards the aperture, *continued above into a short conical apex traversed by a canal, with a broad velum and of a pale yellowish-brown colour*; MANUBRIUM large, subcylindrical; MARGINAL BULBS reddish-brown, with carmine-coloured spots,—one, larger than the rest, bearing a single tentacle, the others without tentacles; the tentacle very extensile, beaded with spherical clusters of thread-cells, of which the terminal one is the largest.

Size, at the time of liberation, about $\frac{1}{25}$ of an inch in diameter.

THE lined appearance of the stem in *Corymorpha* is due to the presence of a number of longitudinal canals excavated in its substance, through which the nutrient fluid circulates. The arrangement of these canals is much the same as that met with in *Tubularia*.

The lower tentacles possess little contractility, differ-

ing in this respect from the oral series, which act as purveyors to the mouth. The number can only be stated approximately, as it varies with age. The arms are pure white; while the proboscis is pink, and the clusters of gonozooids orange-coloured. Forbes says of the *Corymorpha*, that "when placed in a vessel of sea-water it presented the appearance of a beautiful flower. Its head gracefully nodded (whence the appropriate specific appellation given it by Sars), bending the upper part of its stem. It waved its long tentacles to and fro at pleasure, but seemed to have no power of contracting them. Its beauty excited the admiration of all who saw it."

The membranous sheath, according to Allman, invests the entire stem, lying close to it on the upper part, and forming a loose corrugated sac below. Forbes and Goodsir represent it as deciduous, and state that it disappears in the adult, with the exception of the part that envelopes the base. In the specimens which I have examined it covered a large portion of the stem, but did not extend so far as the base of the polypite. It probably varies with age.

A number of tubular and extensile appendages are given off from the lower part of the stem, which are free prolongations of the longitudinal canals. I have little doubt that they are organs of attachment, as I have always found them immersed in the sand, and they are generally thickly coated with it. But, besides these larger processes, the whole of the conical base gives off an immense number of extremely delicate threads, often of very considerable length, which form an entangled mass of interlacing fibres. These are very adhesive; and spreading in all directions through the sand, they gather the particles about them and form a complicated and tenacious root, by which the zoophyte is securely fixed in its place. If the sand be carefully removed, the extremity is seen to be completely villous.

Sars has accurately described this portion of the structure, and has remarked on the difficulty of detaching the *Corymorpha* from its site. When taken up, it has usually a bulb of sand at its base, which is held together by the adhesive threads.

Allman has seen a specimen, when in confinement and free from sand, attach itself to the bottom of the vessel in which it was kept, by means of a multitude of fine tubular filaments, which formed an entangled web-like tissue, and which were ultimately invested with a delicate polypary.

We have here a most interesting modification of the hydrorhiza, adapting it to the peculiar locality in which the *Corymorpha* lives. The ordinary stolonie network, which is suitable only for a firm base, gives place to a multitude of long hair-like adhesive rootlets, which fix the zoophyte securely, even in the yielding sand.

The gonozoid seems to undergo little change after liberation, merely increasing in size.

Hab. Bay of Stromness, Orkneys, in 10 fathoms (Forbes and Goodsir): Shetland (Forbes): Fowey, Cornwall*: Isle of Man (J. A.): Seaham Harbour, Durham, not uncommon in from 6–12 fathoms (G. Hodge): Firth of Forth in about 14 fathoms (G. J. A.).

Corymorpha nutans varies much in size according to the locality. Specimens from the far north reach a height of $3\frac{1}{2}$ or $4\frac{1}{2}$ inches. The Durham examples are smaller; while the Cornish specimen is still more diminutive.

[Near Bergen, Norway, in 30–40 fathoms (Sars): Grand Manan, on a sandy bottom in from 4–15 fathoms, abundant: off West Quoddy Head one hundred, or more, were taken at a single haul of the dredge (Stimpson)†.]

* Mr. Peach has also obtained two other specimens in Fowey Harbour.

† Sars, in a recent paper on *Corymorpha*, has described several new and nearly allied species. Steenstrup has published a tropical form procured from Rio Janeiro.

2. *C. NANA*, Alder.

HYDRACTINIA, *Johnston*, B. Z. 463, woodcut, fig. 79 a.

„ ? (Alder) *Gray*, Cat. Brit. Mus. Radiata, 61.

CORYMORPHA NANA, *Alder*, North. and Durh. Cat. Trans. Tynes. F. C. iii. 108, pl. ix. fig. 7, 8; Supplem. Trans. Tynes. F. C. v. 233, pl. xi.

Plate XXII. fig. 3.

STEM elongated, subcylindrical, *transparent, white or yellowish, with opaque white lines*, bearing towards the lower part of it a number of extensile tubular processes; *polypary* a transparent filmy sheath, *ending at the base in a gelatinous mass (?) by which the animal is attached*; POLYPITES *yellowish*; *oral tentacles about 16–18 in two imperfect rows, aboral tentacles 15–20.*

GONOOID naked, *sessile, urn- or bell-shaped*; UMBRELLA (at the time of liberation) rather deep, semiglobose, transparent white; MANUBRIUM rather long and thick; RADIATING CANALS yellowish, three of them ending in a yellow bulb on the margin, the fourth produced into a club-shaped (?) tentacle.

Height of zoophyte $\frac{1}{2}$ to $\frac{3}{4}$ inch.

“*CORYMORPHA NANA* is a very active animal, constantly changing its form and the proportions of its parts. * * * In many of its states it bears a considerable resemblance to *C. nutans*, from which, however, it differs, not only in the diminutive size, but in the gonophores being sessile (not pedunculated or branched as in the latter), and large in proportion to the size of the animal. The medusoid differs from that of *C. nutans* in having the umbrella rounded at the top; in other respects it is very similar.” (*Alder*.) Alder seems to have described the single tentacle of the gonozoid when in a contracted condition. It probably resembles in structure that of *C. nutans*.

He states that this species produces dissimilar reproductive bodies. On one polypite they were developed into

free zooids; on another they presented a very different appearance, having tuberculated lobes on the upper part, and remaining attached during the whole time that the polypite continued to live, about ten days. Mr. Alder had little doubt of their continuing permanently fixed. He conjectures that the distinction is a sexual one; but we must wait for further observations before we can decide upon its significance. We have, I believe, no analogous fact on record.

Family XII.—Pennariidæ.

POLYPITES *with two sets of tentacles—one oral and capitate, the other aboral and filiform.*

Genus VORTICLAVA, Alder.

GENERIC CHARACTER.—*Polypites borne on simple stems, developed at intervals on a creeping filiform stolon, the whole cœnosarc clothed with a very delicate film-like polypary (?); tentacles in two dissimilar verticils—the oral short and capitate, the aboral long and filiform.*

Reproduction unknown.

THIS genus was founded by Alder after the examination of a single specimen, which had probably not attained its full development. He describes the polypite as solitary and naked; and Wright assigns the same characters to his *V. proteus*. In both cases, however, I believe, the individuals observed were merely primary polypites, and would have given origin in time to a creeping stolon on which other polypites would have been developed. I have a specimen of *Vorticlava* (obtained at Saleombe in South Devon) which

consists of two polypites united by a short adherent base, one of them apparently fully grown, the other of small size and with only four knob-like tentacles round the upper extremity (woodcut, fig. 12). It may perhaps be referable to the *V. proteus*; at any rate it shows what the perfect form of the genus is.

Fig. 12.



The type of the family *Pennariidæ* is the *Pennaria* of Goldfuss, founded on the *Sertularia pennaria* of Cavolini's admirable work (a form that has not occurred on our shores).

1. *V. HUMILIS*, Alder.

"Cat. of Zooph. of North. and Durh.," Trans. Tynes. F. C. iii. 100, pl. iii. figs. 1-4.

Plate XXIII. fig. 1.

STEM nearly cylindrical, tapering slightly towards the upper part; POLYPITE white, semitransparent; oral tentacles 5, short and stout; aboral tentacles 10, rather stout, smooth, about three times the length of the upper. Length of body $\frac{2}{10}$ inch.

MR. ALDER's specimen, which lived with him for several days, "was sluggish, holding itself always in a curved position, as represented in the figure." The mouth is tubular and prominent; the upper tentacles which surround it are generally curved inwards; they bear a cluster of small thread-cells on the capitula.

Hab. On *Corallina officinalis* in a rock-pool between tide-marks, Cullercoats (J. A.): Felixstowe (Busk).

2. V. PROTEUS, T. S. Wright.

"Observations on Brit. Zooph.," Quart. Journ. Microscop. Science, iii. (N. S.)
50, pl. v. figs. 1-6.

Plate XXIII. fig. 2.

STEM, when fully extended, cylindrical and slender, capable of great elongation and contraction, invested by a delicate transparent film; POLYPITE somewhat globular; capitate tentacles 5, filiform tentacles 9.

THE transparent layer which covers the body of the polypite "extends from the foot, where it forms a thick mass, to a ridge which runs beneath the insertion of the lower row of tentacles."

The zoophyte, as it occurred to Dr. Wright, was solitary, and had the power of changing its place. But, as I have explained, his specimens were probably immature, the primary polypites of a species which is compound and fixed in its perfect condition. It may be identical with the Devonshire form to which I have referred before; but in the present state of our knowledge nothing can be said with certainty of the species of *Vorticlava*. A glance at the figures of *V. proteus* will show that it well deserves its specific name.

Hab. On a stone in the "Fluke Hole," Firth of Forth (T. S. W.).

Genus ACHARADRIA, T. Strethill Wright.

GENERIC CHARACTER.—*Stems branched, clothed with a chitinous polypary; polypites with two rows of tentacles—the aboral long and filiform, the oral short and capitate.*

Reproduction unknown.

Dr. WRIGHT has given us a very brief description of this zoophyte. He does not mention or figure any ereeping base; but probably the erect shoots are bound together and rooted by a filiform stolon, as in other cases. "This little Tubularian * * bears the same relation to *Vorticlava* that *Tub. larynx* does to *Corymorpha*." (*Wright*.)

A. LARYNX, Wright.

"Observations on Brit. Zooph.," *Micr. Journ.* (N. S.) iii. 50, pl. v. figs. 7, 8.

Plate XXIII. fig. 3.

STEMS sparingly branched, spirally twisted; POLYPITES pale orange; oral tentacles from 2 to 8, aboral from 4 to 12. Height about $\frac{1}{4}$ inch.

A. LARYNX resembles in habit *Tubularia larynx*.

Hab. On stones, Ilfracombe (T. S. W.).

[The following genus should have been placed amongst the *Podocorynidæ*, p. 35.]

Genus CIONISTES, T. S. Wright.

GENERIC CHARACTER.—*Polypites sessile, with a single verticil of filiform tentacles, developed at intervals on a reticulated stolon; gonophores borne on rudimentary polypites, which are columnar and without either tentacles or clusters of thread-cells; reproduction by means of fixed sporosacs.*

WE have but a slight account of this genus from its

author; and it is difficult to decide upon its true position. It seems to have most affinity with the *Podocorynidæ*, and may be referred provisionally to that family. I had intended originally to place it amongst the *Atractylidæ*, and am now obliged to insert it out of its proper connexion.

C. RETICULATA, T. S. Wright.

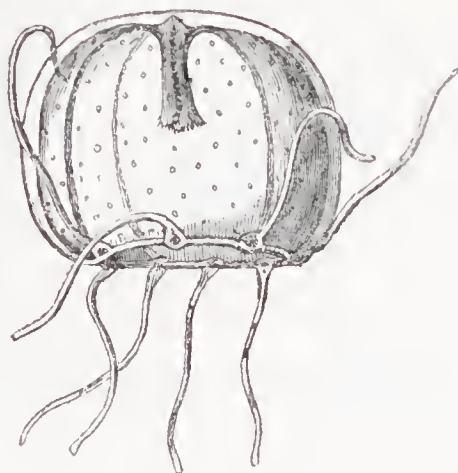
Ann. N. H. for August 1861, (ser. 3) viii. 123, woodcut, fig. 1.

POLYPITES (alimentary) minute, white, with short tentacles, borne at distant intervals on a close network of flattened tubes; GONOPHORES (male) oval, somewhat pointed above, numerous, developed on imperfect polypites, which are thickened towards the apex.

ALL our knowledge of this species is derived from a very brief description by Dr. Strethill Wright, which is not minute enough to be of much value.

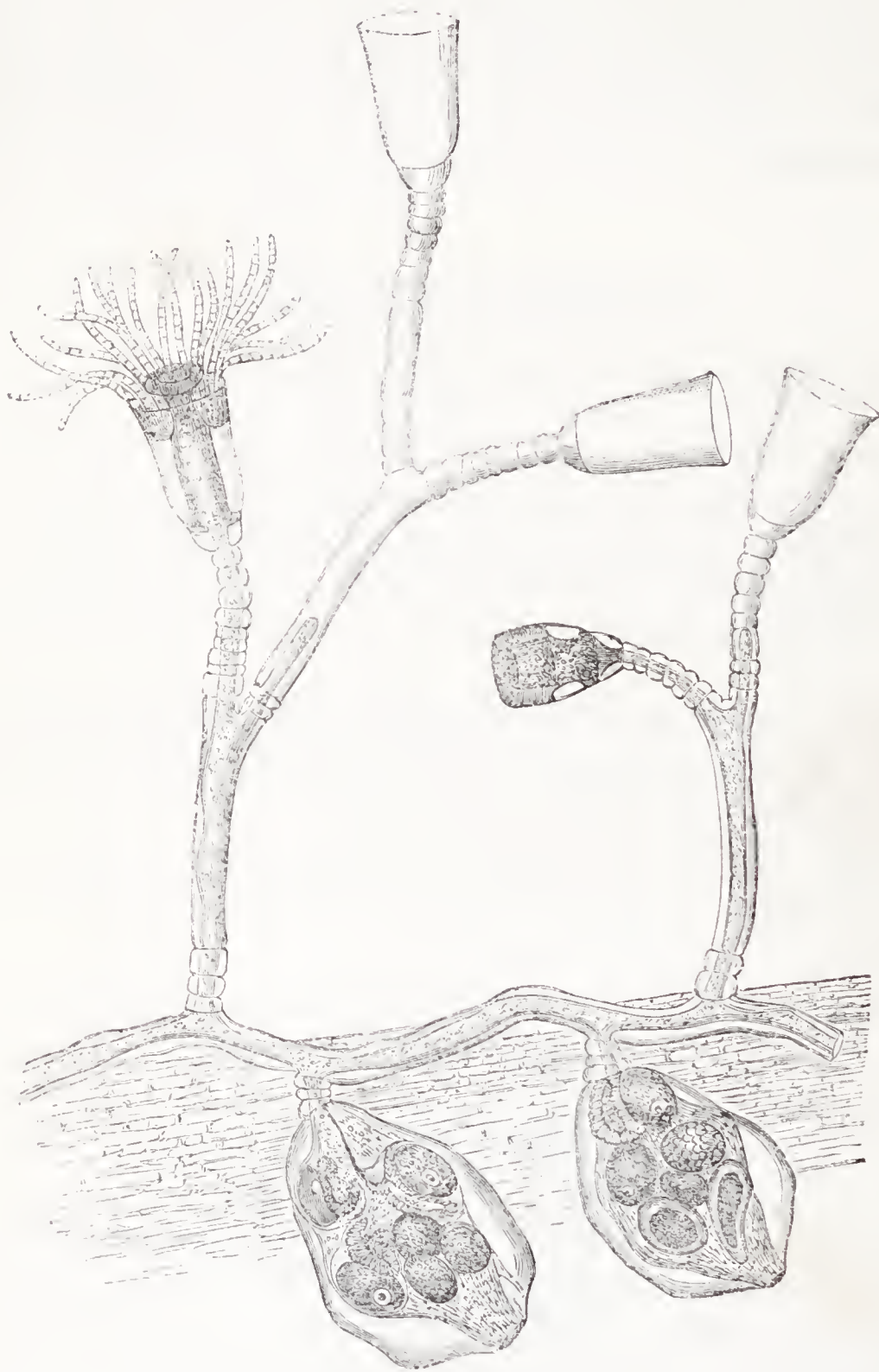
Hab. On an old shell, Granton, near Edinburgh (T. S. W.).

Fig. 13.



Podocoryne areolata (Alder).

Fig. 14.

*Campanularia angulata*, Hincks.

Suborder II.—THECAPHORA.

SERTULARINA, Ehrenberg, Corall. des roth. Meer. 73; Johnston, Brit. Zooph. i. 57.

SERTULARIADÆ, Huxley, Oceanic Hydrozoa, 21.

SERTULARIÆ, Agassiz, Nat. Hist. U. S. iv. 348.

SKENOTOKA, J. V. Carus, Handbuch der Zoologie, ii. 558.

Family I.—Campanulariidæ.

HYDROTHECÆ *terminal, pedicellate, campanulate*; POLYPITES *with a large, trumpet-shaped proboscis.*

THIS family is preeminent for delicate beauty and graceful habit. It includes a very considerable number of British species, of which some are deep-water forms; but a large proportion are found either between tide-marks or at no great distance from the shore.

If we imagine minute crystalline chalices, crenated or plain round the margin and mounted on slender pedicels, twisted spirally or delicately ringed, which are all united and bound to the body on which they grow by the finest network of tubes, we have the form which the polypary assumes in one section of this exquisite group. In another the species are arborescent and sometimes of considerable size, their tree-like tufts presenting the most lovely shapes, the branches laden with the hyaline calyces (variously formed and adorned) and with the vase-like capsules, and the whole structure exhibiting an indescribable delicacy of texture and gracefulness of habit. In both these sections the polypites are generally large and handsome; and when the embossed tentacles are thrown out over the margin of the little crystal dwelling, some drooping downwards, others standing almost erect (like a circle

of guards) around the central proboscis, a prettier sight will not often reward the naturalist.

“Delicacy, transparency, and grace pervade the entire structure; the spirit of beauty has thrown itself into every curve and line: the eye rests with full satisfaction on the little cups, so perfect is their form; and hardly less beautiful are the ringed and twisted pedicels that support them.”

In another section the calyces are curiously operculated, being surmounted by little turrets formed of convergent segments, which open to allow of the passage of the polypite, and close again as it retreats.

The polypites present few diversities. The body, when extended, is elongate, expanding upwards, and terminating above in a very conspicuous cup-shaped proboscis, around which the numerous milk-white tentacles, roughened by the whorls of thread-cells, are ranged, alternately depressed and elevated.

The polypite does not extend to the bottom of the hydrotheca, but rests on a kind of floor a short distance from it, to which the cœnosare or common connecting-thread is prolonged from below.

In one instance at least (*Campanularia flexuosa*, Hincks), the tentacles are united towards the base by a membranous web of extreme tenuity. The gonophores are contained in protective cases (gonothecæ), which exhibit the elegance of form that is so characteristic of the family.

The reproductive zooids in this family present many modifications. In some of the genera they are simple sporosacs, in which the generative products are matured within the capsule, being discharged at length through its orifice. In a few cases the development of the ova is completed within an extracapsular marsupium, which bursts at last and liberates the planules. In other genera

we have free medusiform zooids, and these exhibit different types of structure.

The generic groups in this family are founded for the most part on the differences presented by the reproductive system. In *Lovénella* alone are good distinctive characters supplied by the polypite and caly- cle; in the remaining genera they must be sought altogether in the portions of structure connected with the propagation of the species. As these are not always present, a practical difficulty will often encounter the student; he may be unable, in the first instance, to refer his specimen to its genus, and must go through the species of several allied genera in order to determine its position. A similar difficulty meets the systematist, who can only assign a provisional place to those forms the reproductive phase of which has not been observed*. In one or two cases I have ventured to locate such forms conjecturally; but most of them are ranged for the time under *Campanularia*, with which, so far as the trophosome is concerned, they agree, and must be referred to their proper place in the system as their reproductive history is known. The number of such species is but small. Much more numerous probably are the reproductive zooids that have not yet been traced to the Hydroid stock.

The *Campanulariidæ* are very widely distributed over the globe. Many of the British forms have been obtained on the Atlantic coast of North America, as well as a considerable number of species belonging to the genera *Clytia* and *Obelia* which have not been found in our seas. One or two fine species of *Campanularia* are described by A. Agassiz from the Pacific side—one of them, of gigantic size, ranging from San Francisco to Behring's Straits.

* These remarks apply to many other families.

The *Campanularia volubilis* (Linn.) has been observed at the following points:—the coast of Massachusetts, the Gulf of St. Lawrence, Iceland, the North Cape, and Shetland. *Obelia geniculata* has been tracked along much the same course. All the Norwegian species have, I believe, been obtained in Great Britain.

Of the Mediterranean species, which are not numerous so far as known to us, a large proportion occur on our own coasts.

In Australia and New Zealand the family seems to be well represented by forms which differ from the European. I have described a remarkable species from Melbourne (*Hincksia*, Agassiz), which has very curious decumbent gonothecæ; and I possess a second from Australia, which exhibits the same peculiarity.

Nowhere perhaps is Campanularian life to be met with in greater profusion than on the floating weed of the gulf-stream. I have seen large masses of it netted over by the delicate white fibre of a species allied to *Clytia Johnstoni*, from which rose thousands of the annulated stalks, surmounted by the prettiest campanulate calyces.

Genus CLYTIA, *Lamouroux* (in part).

Der. From *Clytie*, one of the Oceanides.

CAMPANULARIA (in part), Lamarck, An. s. V. (2nd ed.) ii. 129.

CLYTIA, Agassiz, N. H. U. S. iv. 354; Van Beneden, Faune Litt. de Belg. Polypes, 165.

TROCHOPYXIS, Agassiz, N. H. U. S. iii. 46; iv. 354.

PLATYPYXIS, Agassiz, N. H. U. S. iv. 306, 354.

EUCOPE (in part), Gegenbaur, "Versuch eines Syst. der Medus.," Zeitsch. für wissenschaft. Zool. viii. 241 (the free zooid).

CAMPANULARIA, Allman, Ann. N. H. for May 1864.

GENERIC CHARACTER.—*Stem simple or slightly branched,*

rooted by a creeping stolon; hydrothecæ bell-shaped, without operculum; polypites with a large trumpet-shaped proboscis; gonothecæ borne on the stolon and on the stems, and producing free medusiform zooids.

Gonozooid: Umbrella (at the time of liberation) almost globular; manubrium short, 4-lipped; radiating canals 4; marginal tentacles 4, with bulbous bases, which are not ocellated; lithocysts 8, two in each interradial space, borne on the free margin of the umbrella.

The number of tentacles and of lithocysts increases with age, and the shape of the umbrella undergoes considerable change.

I FOLLOW Agassiz and Van Beneden in adopting Lamouroux's name of *Clytia* for the present section of the Lamarekian genus *Campanularia*, which must be broken up into several distinct groups. It is distinguished by its somewhat deep-belled gonozooid with a comparatively small number of arms, and with the lithocysts between the tentacles and not upon them. The species that produce free sexual zooids with a depressed umbrella and numerous reentrant arms, and the lithocysts placed on the base of the tentacles, must bear the name *Obelia*, which was introduced by Péron and Lesueur in 1809. To the species that are destitute of a medusiform zooid, Lamarek's old and well-established designation, which was applied originally to simple and branched forms alike, may be assigned.

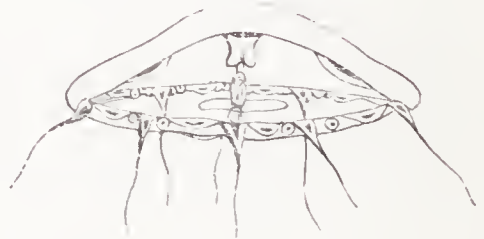
The *Laomedea* of Lamouroux and Johnston was formed to include the branched and tree-like as distinguished from the simple and creeping species—a division that does not represent the natural affinities and cannot be maintained. In choosing between the various names that have a claim to be retained for the new groups, I have thought

it better not to apply the one which immediately suggests to the mind this false distinction, and has become identified with the branching forms, to genera composed either wholly or in part of simple species. I have therefore retained *Clytia*, which was assigned by its author to such species, for the first section, and *Campanularia* for the third*.

Besides the groups just referred to, Lamarck's *Campanularia* would embrace within its ample bounds the *Gonothyræa* of Allman, while in *C. syringa* it includes the type of yet another genus.

The present genus affords a striking illustration of the changes which the sexual zooid may pass through as it advances towards maturity. According to the observations of A. Agassiz†, that of *C. bicophora* (which seems to be our *C. Johnstoni* with an American title) loses after a time its globular outline, and assumes the appearance represented in the accompanying figure (woodcut, fig. 15). The lower portion of the bell bulges out, the tentacles are doubled in number, and the rudiments of eight more are traceable on the margin. The ovaries have also increased in size.

Fig. 15.



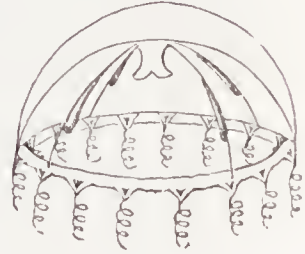
In its adult stage the zooid is hemispherical in form, and measures a quarter of an inch in diameter; it is fur-

* Allman has apportioned these names somewhat differently. He has discarded *Clytia* on the ground that it has been less generally used by authors, and gives *Laomedæa* to the third group. To me, I confess, a less familiar name seems preferable to one with which inconvenient associations are connected; and it must not be forgotten that *Clytia* finds a place in the two latest works of any magnitude on the Hydroida, those of Agassiz and Van Beneden.

† North American Acalephæ, p. 78, figs. 108-110.

nished with sixteen long tentacles; and additional lithocysts are also developed, one on each side of the four primary tentacles (woodcut, fig. 16). The ovaries are "brownish purse-like glands, extending towards the base of the proboscis."

Fig. 16.



I have never witnessed these changes in *C. Johnstoni*; but I have found the sporosacs present *before* the escape of the gonozooid, and laden with ova shortly after; so that the reproductive functions are discharged in the earliest as well as in the later stages of its existence. Wright has made similar observations, and has seen the ova developed into young Campanularians in about a week after the escape of the zooid from the capsule.

Agassiz is of opinion that three of Gegenbaur's species of *Eucope* (*E. campanulata*, *E. thaumantoides*, and *E. affinis*) are only different ages of *Clytia bicophora*; and I have little doubt that the opinion is correct.

C. JOHNSTONI, Alder.

SERTULARIA VOLUBILIS, *Ellis & Soland. Zooph.* 51, pl. iv. figs. e, f, E, F.

CAMPANULARIA VOLUBILIS, *Johnst. B. Z.* 107-108, woodcut, fig. 18; *Couch*, *Corn. Faun.* pt. 3. 40, t. xi. fig. 1; *Hincks*, "on Reproduction of Campanulariadae," *Ann. N. H.* for July 1852, pl. iii. fig. 5.

„ JOHNSTONI, *Alder*, *North. & Durh. Cat.* in *Trans. Tynes.* F. C. v. 126, pl. iv. fig. 8; *T. S. Wright*, *Ed. New Phil. Journ.* (N. S.) for April 1858; *Allman*, *Proc. Roy. Soc. Ed.* for Dec. 6, 1858.

EUCOPE CAMPANULATA, E. THAUMANTOIDES, E. AFFINIS (the free zooid), *Gegenbaur*, *Syst. d. Medus.*, *Zeitsch. f. wissench. Zool.* viii. 243, 244, pl. ix. figs. 8, 9, 10, 12, and 13.

CLYTIA BICOPHORA, *Agassiz*, *N. H. U. S.* iv. 304, pl. xxvii. figs. 8, 9; pl. xxix. figs. 6-9.

Plate XXIV. fig. 1.

STEMS long, transparent, simple or slightly branched,

ringed at the base and at the top, the intermediate portion generally smooth; HYDROTHECÆ deeply campanulate, and rather large, expanding slightly above, with 10–12 strong triangular teeth round the rim; GONOTHECÆ borne on the creeping stolon, and occasionally on the stem, ovate, strongly ringed transversely—the segments more or less carinated—truncate at the top and shortly pedunculate.

GONOOZOID.—UMBRELLA (at the time of liberation) globose, perfectly transparent, with numerous thread-cells imbedded in its substance, and a very wide velum; MANUBRIUM short, somewhat swollen towards the base, with a 4-lipped mouth; MARGINAL TENTACLES very extensile, muricated, halfway between each pair a small tubercle (rudimentary tentacle) with a lithoeyst on each side of it.

C. JOHNSTONI is one of the commonest of our British Campanulariidæ. The calyces are generally large and the pedicels of great length: but there is considerable variation in these points; on the same specimen the calyces are often of the most various sizes. The denticulation of the margin is strongly marked. The stems for the most part have the middle portion smooth; but there is sometimes a little ringing even here, and I have met with a variety (which I do not venture to separate from *C. Johnstoni*) in which they are closely ringed throughout. The capsule is more or less produced, and the rings upon it are much more clearly defined in some specimens than in others.

The polypite is large and handsome, with between 20 and 30 long, muricated tentacles.

C. Johnstoni is occasionally branched, and bears the capsules on the stem. I have not seen more than one or two branches in any case (exact copies of the original shoot), on which a small and imperfectly formed capsule

was usually present. Sometimes, however, as I learn from Dr. Strethill Wright, two or three branches spring from a little below the polypite, and "these secondary stems in like manner give off tertiary stems," the capsules in such specimens being often axillary.

The free zooid seems to have been first noticed by Van Beneden, who has figured it in a paper entitled "Un mot sur le Mode de Reproduction des Animaux Inférieurs," published in 1847.

It is a most exquisite organism, about $\frac{1}{40}$ of an inch in height at the time of liberation, of graceful form and the purest transparency; its presence is indicated to the naked eye by five opaque-white dots, marking the four arms and the manubrium. The perfectly translucent umbrella can only be detected by the aid of a lens. The arms during motion are curled up in several spiral coils, but are capable of great extension. The reproductive sacs are borne on the radiating canals as minute globular enlargements. Each of the lithocysts on the free margin of the umbrella contains a single spherule of carbonate of lime, which is highly refractile. These charming little floating polypites are cast off in immense numbers by the fixed colonies of the *Clytia*, each freighted with the seed of new generations; so that we may not wonder at the profuse distribution of the species. M. Lacaze-Duthiers, writing from the neighbourhood of St. Malo, says that he could not take up any water from the sea without meeting with some of them. He was able to observe the ciliated embryo, which he describes as resembling a *Paramecium* in form, and about half a millimetre long.

The *Campanularia Gegenbaurii* of Sars (Middelhavet's Litt. Faun. p. 48; Gegenbaur, 'Generationswechsel,' pl. i. figs. 1, 2) is perhaps a mere variety of the present species.

Hab. Extremely common from between tide-marks to

deep water. Like other Campanularians it shows a predilection for the red weeds. The ribbon-like leaves of *Zostera marina* are also frequently profusely covered with it; indeed it is generally distributed and adorns with its crystal cups and ringed pedicels the most various marine substances.

[Belgium; Brittany; Norway (Van Ben.): coast of France generally (Lacaze-Duthiers): "from Grand Manan Island, at the extreme eastern coast of Maine, all along the New England coast to Vineyard Sound, south of Cape Cod" (Agassiz).]

Genus OBELIA, Péron & Lesueur*.

LAOMEDEA, Lamouroux, Bulletin Philomatique, 1812.

CAMPANULARIA (in part), Lamarck, An. s. V. (2nd ed.) ii. 129.

MONOPYXIS, Ehrenberg, Corall. roth. Meer. 73.

THAUMANTIAS (in part), Forbes, Brit. Naked-eyed Medusæ, 41.

EUCOPE (in part), Gegenbaur, "Syst. d. Medus.," Zeitschr. f. wissenschaft. Zool. viii. 241 (the free zooid); Agassiz, N. H. U. S. iv. 351.

OBELIA, M'Crady, Gymnoph. Charleston Harb.; Agassiz, N. H. U. S. iv. 351; Allman, Ann. N. H. for May 1864.

GENERIC CHARACTER.—*Stem branching, plant-like, rooted by a creeping stolon; hydrothecæ campanulate, without operculum; gonothecæ borne on the stems and branches; reproduction by free medusiform zooids.*

Gonozooid: Umbrella (at the time of liberation) depressed and disk-like; manubrium short and quadrate; radiating canals 4; marginal tentacles numerous (increasing in number with age), prolonged at the base and projecting inwards; lithocysts 8, two in each interradial space, borne on the inner side of eight of the tentacles near the base.

M'CRADY† was the first to restore the name *Obelia*, con-

* "Histoire générale des Méduses," Ann. du Muséum, xiv. 43, 1809.

† Gymnophthalmata of Charleston Harbour, p. 94.

ferred by Péron and Lesueur at a very early date on a supposed Medusa, which we now know to be the reproductive element of a Campanularian zoophyte. Agassiz has adopted it for one section of the species, producing gonozooids with a shallow, disk-like umbrella; and Allman has extended it to the whole group. In this, I have no doubt, he is right. The character employed by Agassiz to distinguish his genera *Eucope* and *Obelia* (the number of arms which the sexual zooid possesses at the time of liberation) is barely of specific value.

The younger Agassiz insists upon the presence or absence of sporosacs at the time of liberation as an important character, and goes so far as to separate the *O. geniculata* of Wright from that of Gosse because they differ in this respect. To the former, which he identifies with the *Eucope diaphana* of his father's great work, he assigns the name of *alternata*. I feel convinced that this is a mistaken view; and unfortunately it is one which introduces confusion and difficulty into the science by enlarging the list of synonyms. The fact is, that the gonozooids contained in the same capsule leave it in very various stages of development; this is proved by the differences in size and the condition of the marginal tentacles at the time of liberation*. And I have no doubt that the earlier or later appearance of the ovaries is to be explained in the same way: it is a variation in the degree of development, and not a specific difference. On the free zooids of *Clytia Johnstoni* Wright and myself have found ovaries with ova directly after their escape; Allman, on the contrary, met with none on his specimens. A. Agassiz found them in

* Wright also mentions another diversity amongst the gonozooids of *O. geniculata*. In some the ovaries were close to the manubrium, in others midway between the base of it and the marginal canal ("Observat. on Brit. Zoophytes," Ed. N. P. Journ. for Jan. 1859).

the young zooid, "hardly visible, as very short narrow lines on both sides of part of the upper half of the radiating tubes"* . These observations point to variations in the time of development, and prove that the period at which the sporosacs appear is not a point of any special significance.

In the present work the *Eucope* and *Obelia* of Agassiz, embracing respectively the species with 24-armed and 16-armed gonozooids, are blended in the single genus *Obelia*; and the *E. alternata* (A. Agassiz) is ranked as a synonym of the well-known and widely distributed *O. geniculata* (Linnæus).

It appears from the observations of A. Agassiz that, in this genus, "with advancing age the Medusæ lose the habit of swimming with the proboscis uppermost, and gradually assume the usual mode of swimming of jelly-fishes." The arms increase greatly and, it would seem, rapidly in number, and the sporosacs become larger and change their form with age, differing somewhat in shape in the two sexes.

In the *Thaumantias* of Forbes's Monograph several members of this genus are included; and some of his species are only various stages of one and the same *Obelia*.

The earliest figure of the medusiform zooid with which I am acquainted is found in Baster's 'Opuscule Subseiva' (1762)†. He gives a very fair representation of it, and describes it as a polyp which had fallen from the coralline "*ob vehementiorem aquæ infusionem.*" He observed a considerable number of these detached polyps swimming freely in the water, and fancied that in some cases they fixed themselves again on the branches

* North American Acalephæ, p. 78.

† Vol. i. p. 27, pl. v. fig. D.

from which they had dropped. His inference was, that the polypites and the coralline were distinct organisms, and had no essential connexion with one another.

1. O. GENICULATA, Linnæus.

"KNOTTED-THREAD CORALLINE," *Ellis*, Corall. 22, pl. xii. *b*, B.

SERTULARIA GENICULATA, *Linn.* Syst. 1312; *Pallas*, Elench. 117; *Lamk.* An. s. Vert. (2nd ed.) ii. 149.

LAOMEDEA GENICULATA, *Lamx.* Cor. flex. 208; *Johnst.* B. Z. 103, pl. xxv. figs. 1, 2; *Gosse*, Devon. Coast, 84, pl. iv. (the free zooid).

CAMPANULARIA GENICULATA, *Flem.* Brit. An. 548.

MONOPYXIS GENICULATA, *Ehrenberg*, Corall. roth. Meer. 73.

EUCOPE DIAPHANA, *Agassiz*, N. H. U. S. iv. 322, pl. xxxiv. figs. 1-9*.

OBELIA GENICULATA, *Allman*, Ann. N. H. for May 1864.

EUCOPE ALTERNATA, *A. Agassiz*, North Am. Acaleph. 86.

Plate XXV. fig. 1.

STEM *zigzag*, sometimes sparingly branched, *jointed at each of the flexures, and thickened immediately below them, so as to form a series of projections or rests, from which the pedicels rise*; HYDROTHECÆ *somewhat ob-conical*, rather short, the length slightly exceeding the width, *with a plain margin, borne on short, annulated stalks (rings 4-6), which are suberect and taper slightly upwards*; GONOTHECÆ axillary, urn-shaped, attached by a short ringed stalk (3-4 rings).

GONOOZOID.—UMBRELLA (at the time of liberation) very shallow, discoid, colourless, presenting a reticulated appearance; MARGINAL TENTACLES 24; SPOROSACS oval.

THIS species is distinguished from all its British congeners by the peculiar structure of the stem. It is divided by simple joints into a number of short and rather stout in-

* The *Thaumantias diaphana* described by Agassiz in the Mem. Am. Acad. iv. p. 300, is, according to A. Agassiz, the sexual zooid of another species, and was wrongly referred by him to the present species in the 'Contributions to the Nat. Hist. of the United States.'

ternodes, which are elbowed above on alternate sides, so that a kind of bracket is formed for the support of the calyces. The capsules are of a most elegant form, resembling, as Dr. Johnston has remarked, a Greek vase or urn; they are elongate, and taper off gradually from the flattened top to the base, becoming very slender below. From the summit rises a short tubular orifice. They very generally project at right angles to the plane in which the calyces lie*; at times, however, they seem to be appressed to the stem. They contain a large number of gonophores. The gonozooids are beautiful objects, and very lively in their movements; they are liberated in great numbers, and are excluded in very various stages of development:—some small, with the arms stunted; others much larger, with the arms of considerable length.

The shallow swimming-bell is often reverted, the manubrium hanging below the convex surface, and the tentacles drooping in graceful curves from the margin. In this state they might serve as the model for a vase. The lithocysts contain a refractile spherule, and stand out prominently on the basal portion of the tentacle. I have noticed a little orange-colour at the base of the manubrium.

There are two marked forms of this species:—one delicate, of a pure whiteness and rather humble growth; the other much larger and coarser in habit, and less strongly zigzagged. I have seen specimens in which the scale of all the parts was much smaller than in the common form. A dense forest of this variety covers a broad frond of seaweed in my collection, bearing the elegant capsules in great profusion; they are developed on the creeping

* Agassiz has pointed this out in his account of the American *Eucope diaphana*, a species which I cannot hesitate to identify with the present (N. II. U. S. vol. iv. p. 324).

stolon, as well as in the axils, and are in some cases borne on rather long peduncles. The number of gonozooids liberated from a colony of this kind, in which the capsules, each containing perhaps a dozen of them, cover a large proportion of the shoots, and are crowded in clusters on the creeping fibre, must be enormous; and it must be remembered, in estimating the produce, that each of the zooids bears the seed of many colonies. Specimens are often coloured red, the colour being due to a very minute alga, which covers the surface with a network of chain-like vegetation. *O. geniculata* is a phosphorescent species; and the sudden illumination of a forest of it on some sombre Laminarian frond is a truly beautiful spectacle. If it is agitated in the dark, a bluish light runs along each stem, flashing fitfully from point to point as each polypite lights up its little lamp.

Hab. On seaweed, and especially the fronds of *Laminaria digitata*, near low-water mark; very common and generally distributed.

[Massachusetts, U. S. (Agassiz): Hamilton Inlet, Labrador, in 15 fath. (T. H.): North Cape and neighbouring coasts (Sars).]

2. *O. GELATINOSA*, Pallas.

SERTULARIA GELATINOSA, *Pallas*, Elench. 116; *Fleming*, Edinb. Phil. Journ. ii. 84.

LAOMEDEA GELATINOSA, *Lamx.* Corall. flex. 92; var. β , *Johnst.* B. Z. 104, pl. xxvii. fig. 1; *Hincks*, Devon. Cat., Ann. N. H. (3rd ser.) viii. 259.

CAMPANULARIA GELATINOSA, *Lamk.* An. s. V. (2nd ed.) 134.

Plate XXVI. fig. 1.

SHOOTS *clustered*, rising from a fibrous and spongy mass; STEM *compound*, made up of numerous delicate tubes, closely bound together, tapering upwards, straight

or very slightly sinuous, of a dark brown colour, *thickly branched*; branches given off at short intervals in pairs, which are placed alternately on opposite aspects of the stem, so as to present a subverticillate arrangement, compound for some distance above the point of origin, the upper portion consisting of a single tube and very hyaline, divided and subdivided into very numerous alternate ramules, and annulated above the divisions; HYDROTHECÆ very small, of the thinnest texture, campanulate, supported on rather long ringed and tapering pedicels, the margin cut into denticles of a castellated form, slightly hollowed out at the top; GONOTHECÆ axillary, ovate, somewhat flattened at the top, with a raised aperture.

GONOOID with 16 arms at the time of liberation.

PALLAS's description of this species is admirable, and it is the only one we possess that is not positively incorrect. Fleming took the rim of the calyces to be plain, and conjectures that Pallas may have seen the tips of the tentacles showing above the edge and mistaken them for erenations! Johnston adopted Fleming's opinion on this point, and has besides confounded the true *O. gelatinosa* with a very different form, the *Campanularia flexuosa* (Hineks). Many subsequent authors have accepted his view; and much confusion has been the result. Milne-Edwards, supposing Fleming's even-rimmed *Campanularia* to be distinct from Pallas's *Sertularia gelatinosa*, has made it a species and given it the name of *Laomedea Flemingii*; but there is no doubt that Fleming had the same form before him as the Russian naturalist*, the erenature having escaped his notice owing to the extreme tenuity of the margin.

Fig. 17.



* I have been informed by the late Mr. Alder that he had examined speci-

O. gelatinosa is a well-marked species; it attains a height of 8 or 10 inches. A fine specimen procured at Exmouth was about 6 inches high, and consisted of an exquisite cluster of as many as 10 shoots.

The branches, which are divided into a multitude of extremely delicate ramules, are of a tender, pellucid whiteness, with the exception of the basal portion, and contrast with the thick and dark-coloured composite stem; they occur in pairs, which originate close together on the stem, but immediately diverge ("*furcæ in modum*") and spread out on each side. They are long in the lower portion and middle of the stem, drooping slightly, and diminish in size above, giving a very elegant form to the shoots.

A single calycle commonly springs from the fork formed by the dichotomous division of the branchlets. The pedicels of the *terminal* calycles are of unusual length, ringed at the top and bottom and smooth between.

Hab. Between tide-marks; not common. Exmouth (T. H.): Cornwall (C. W. P.): "very abundant on some points of the Solway at low-water mark on a stony bottom" (Sir W. Jardine): the Tay, towards Flisk beach, in brackish water (Fleming): Shetland (Dr. Coldstream): Liverpool

mens of *O. gelatinosa* received from Fleming, and had assured himself that they were really identical with Pallas's zoophyte. Kirchenpauer, in his interesting work entitled 'Die Seetonnen der Elbmündung' suggests that Fleming may have had before him the form which I have named *L. flexuosa*, and that Milne-Edwards should have the credit of first perceiving its claim to specific rank. In this case his name (*Flemingii*) would supersede *flexuosa*. But Fleming's description could not apply to the latter form; so that, even if we had not Alder's unimpeachable testimony, the supposition would be untenable.

The *Campanularia gelatinosa* of Van Beneden's Mémoire has no right to its name. It is quite distinct from the present species, and is probably the *S. longissima* of Pallas. Amongst American authors, Leidy, Stimpson, and Gould have applied the name to species which differ, I believe, from the one to which it properly belongs.

(Dr. Collingwood). Dr. Collingwood writes, "The most common and characteristic zoophyte (next to *Tubularia indivisa*, perhaps) of our shores. It is interesting as being a favourite feeding-ground for some minute forms of Nudibranchiata (e. g. *Eolis despecta*, *E. exigua*, *E. concinna*)."

It is in the greatest profusion in the tide-pools of the Dingle Rocks, where it attains a large size. Also abundant at Egremont, Hilbre Island, and other places.

[*"Mare Belgium alluens,"* Pallas.]

3. *O. LONGISSIMA*, Pallas.

SERTULARIA LONGISSIMA, *Pall. Elench.* 119.

MONOPYXIS LONGISSIMA, *Ehrenb. Corall. roth. Meer.* 73.

LAOMEDEA DICHOTOMA, var. β , *Johnst. B. Z.* 102.

LAOMEDEA LONGISSIMA, *Alder, North. & Durh. Cat. in Trans. Tynes. F. C.* iii. 121; *Suppl. Trans. Tynes. F. C.* v. 237; *Hincks, Devon. & Cornw. Cat., Ann. N. H. (3rd ser.)* viii. 259.

CAMPANULARIA GELATINOSA, *Van Beneden, Mém. sur les Campanul.* 33, pl. i. & ii.

Plate XXVII.

STEM filiform, *flexuous, giving off much-ramified branches at short intervals* and ringed above their origins, of a dark horn-colour, sometimes black, and of great length; branches alternate, long and spreading, the principal stem flexuous, with pinnae springing from each bend, which are themselves more or less branched, annulated above every division; HYDROTHECÆ campanulate, rather large and deep, of very delicate texture, the margin cut into blunt and shallow teeth, borne on rather long ringed pedicels, which taper upwards; GONOTHECÆ axillary, ovate, smooth, with a raised central aperture. GONOOOID (at the time of liberation) with 20–24 tentacles.

O. LONGISSIMA attains a height of a foot or upwards, and is of very graceful habit. Its form is somewhat pyramidal, as

the branches gradually decrease in length towards the apex. The stem is distinctly flexuose and of a very deep horn-colour, becoming black in older specimens. The branches, which towards their extremities are very delicate and light-coloured*, are placed at no great distance from one another, and are in most respects copies in miniature of the parent stock. Their pinnæ, which diminish in size towards the top of the branch, are alternate, and are subdivided into numerous branchlets; the axils of these branchlets are commonly occupied by a calycle or a small shoot. The calycles are frail and deciduous, and it is difficult to obtain specimens on which they are present.

The *C. gelatinosa* of Van Beneden is clearly identical with the present species, although he tells us that the rim of its hydrothecæ is plain. The very shallow dentation of the hyaline and attenuated margin may easily have escaped his observation. He has figured the sexual zooid with well-developed, spherical ovaries. In masses of zoophyte cast ashore after strong winds this species is often very abundant, and is at once recognized by its long, dark, thread-like stems.

Hab. Rather deep water, common: Northumberland, frequent (J. A.): Peterhead and Wick, deepish water; Gorran Haven, Cornwall, plentiful (C. W. P.): Filey, Yorkshire; Devon, abundant in the trawl refuse (T. H.): Portmarnock. Though I am only able to give a few localities for this species, I have no doubt that it is very generally distributed. Till lately it had been confounded with *O. dichotoma* †.

[Coasts of Belgium, most abundant (Pallas): Mouth of the Elbe (Kirchenpauer).]

* “* * *substantia* * * *albida, mollis, tenera*,” Pallas.

† We owe its restoration to specific rank to the sagacity of Mr. Alder.

4. *O. DICHOTOMA*, Linnæus.

"SEA-THREAD CORALLINE," *Ellis*, Corall. 21, pl. xii. figs. *a*, *A*.

SERTULARIA DICHOTOMA, *Linn. Syst.* 1312; *Ellis & Soland. Zooph.* 48.

LAOMEDEA DICHOTOMA, var. *α*, *Johnston*, B. Z. 102, pl. xxvi. figs. 1, 2; *Alder*, North. and Durh. Cat. Trans. Tynes. F. C. iii. 121.

Plate XXVIII. fig. 1.

STEM filiform, *slender, nearly straight, irregularly branched*, ringed above the origin of the branches, of a deep horn-colour; branches *suberect, often very long, and more or less ramified*, ringed at intervals, a single calycle in the axils; HYDROTHECÆ alternate, *broadly campanulate and deep, polyhedral above, each side corresponding with a very slight sinuation of the margin*, borne on ringed pedicels, which vary in length from 4 or 5 to as many as 16 rings; GONOTHECÆ axillary, *slender, smooth, widening from the base upwards, and terminating above in a raised, somewhat conical aperture*.

GONOOID.—UMBRELLA very shallow, without thread-cells; MANUBRIUM trumpet-shaped; MARGINAL TENTACLES (at the time of liberation) 16.

It is difficult to settle the synonymy of this species, as the descriptions of the older authors are wanting in minuteness and precision, and several kindred forms have been confounded under the Linnean name *dichotoma*. I have retained it for the present form, which seems to correspond best with the Ellisian and Linnean species, and have only given such synonyms as are undoubted.

O. dichotoma is of comparatively humble size, and has none of the subverticillate mode of growth which gives so much beauty to its near ally *O. flabellata*. The stems and branches are almost straight; the latter are irregularly distributed, often very long and straggling, and more or less branched. They are intermingled, on the main shoots, with simple ringed pedicels bearing a single calycle. The

hydrotheca is large, and both broad and deep. The rim has usually been described as perfectly plain; but on close investigation it is found to be *very* slightly sinuated, and the depressions answer to a number of sides or faces, which give a polyhedral figure to the upper portion of the cup. This structure can only be detected by careful examination with the microscope.

The differences between the gonozooids of the different species of *Obelia* are very slight, at least in their earliest stage. The multiplication of the tentacles is carried to a great extent as the zooid advances towards maturity; Gegenbaur describes his *Eucope polystyla*, which he had traced to a Campanularian stock, as possessing one hundred and twenty of them.

Hab. Common: often parasitical on other zoophytes.

5. O. FLABELLATA, Hincks.

? SERTULARIA DICHOTOMA, *Dalyell*, Rem. An. Scotl. 212, pl. xli.

CAMPANULARIA FLABELLATA, *Hincks*, Ann. N. H. (3rd ser.) xviii. 297.

Plate XXIX.

STEM filiform, *somewhat zigzag, branched*, strongly annulated above the origins of the branches, of a dark horn-colour; branches *alternate, flexuous*, given off at each bend of the stem, *rather short and fan-shaped, divided and subdivided dichotomously*, and ringed above each division, *generally forked immediately above the point of origin, the arms of the fork tending in opposite directions, and giving a subverticillate appearance to the ramification*; HYDROTHECÆ *alternate, short and subtriangular, with a wide aperture and an entire margin*, borne on ringed and tapering pedicels of variable length; GONOTHECÆ axillary, ovate, somewhat flattened at the top, with a short tubular orifice, attached by a ringed stalk.

GONOOZOID ———?

THIS species seems to have passed, like *O. longissima*, as a variety of *O. dichotoma*; it is of much larger size, rising to a height of 8 or 10 inches, or perhaps more. The ramification is perfectly regular, the branches short, springing alternately from the stem, and forking immediately above the base into two principal shoots, each of which is divided and subdivided dichotomously. The arms of the fork tending in opposite directions give the branch its somewhat flabellate form, and to the whole zoophyte its verticillate appearance.

The decidedly flexuous character of both stems and branches offers another point of contrast with *O. dichotoma*. The calyces, too, are formed on another pattern, being shorter and subtriangular.

If I am right in identifying this species with the *C. dichotoma* of Dalyell (and his description and figure agree better with it than with *O. longissima*, the only other allied species), the gonozoid has about 23 (probably 24) tentacles, forming a "pendent marginal fringe." He gives it the name of *Tintinnabulum*, from its resemblance to a hand-bell.

O. flabellata is separated from the preceding species by a group of distinctive characters—the subverticillate habit, the flabelliform branches, the flexuous stems, the short subtriangular calyx, and the much larger size.

Hab. Tenby, on rocks in tide-pools (J. A.): Scotland (Sir J. Dalyell).

Referred provisionally to this genus.

6. O. PLICATA.

Plate XXX. fig. 1.

SHOOTS *clustered*; MAIN STEMS *composed of a large number of very slender, flexuous tubules bound together, thick below and tapering upwards, sending off a multitude of branches*; BRANCHES, some compound, and some simple and very delicate, of great length and much ramified, annulated above the origin of the branchlets; HYDROTHECÆ *alternate, broadly campanulate, even-rimmed, and borne on ringed pedicels.*

GONOTHECÆ unknown.

Height between 3 and 4 inches.

THE only other British *Obelia* which has a thick compound stem, the *O. gelatinosa*, differs widely from *O. plicata* in its habit of growth and in the character of its hydrothecæ. The latter species forms large clusters of shoots, which are remarkable for their luxuriant ramification. The main stem is a bundle of delicate tubes closely adherent to one another, and gives off branches at short intervals; those on the lower portion are thick and compound, those above becoming gradually more slender, until towards the extremity of the shoot they are perfectly simple. The stem itself, of course, diminishes proportionately as bundle after bundle of the tubular strands that compose it is given off, and tapers away towards the top. The branches are very long, and clothe the stems densely to the summit; they are generally much ramified, so that the habit of the species is eminently shrubby and luxuriant.

The calycle very much resembles in form that of *O. dichotoma*.

Hab. Shetland (J. G. Jeffreys).

Genus CAMPANULARIA, *Lamarck* (in part).Der. *Campanula*, a bell.

LAOMEDEA, Lamouroux (in part).

? SILICULARIA, Meyen, Nov. Acta &c. xvi. 1834*.

ORTHOPYXIS, Agassiz (for some of the species), N. H. U. S. iv. 355.

LAOMEDEA, Agassiz, N. H. U. S. iv. 352; Allman, Ann. N. H. for May 1864.

GENERIC CHARACTER.—*Stems simple or branched, rooted by a filiform stolon; hydrothecæ bell-shaped and hyaline, without operculum; polypites with a large, cup-shaped proboscis; gonothecæ borne on the stems or on the creeping stolon; gonophores containing fixed sporosacs, which mature their products within the capsule.*

THE genus *Campanularia* as now restricted includes no form that would not come under the Lamarckian definition of it; it embraces, however, certain portions of Lamouroux's *Laomedea*. Agassiz has formed the genus *Orthopyxis* for one or two species in which the sporosac is furnished with branching gastrovascular canals; the modification, however, is too trivial to stand as the sole criterion of a genus. There is no important difference between the sporosac with these canals and the sporosac without them, so long as they are not subservient to the purposes of free existence.

Section a. With simple and unbranched stems.

1. *C. VOLUBILIS*, Linnæus.SERTULARIA VOLUBILIS, *Linn. Syst.* (12th ed.) 1311.

“SMALL CLIMBING CORALLINE WITH BELL-SHAPED CUPS,” *Ellis, Corall.* 24, pl. xiv.
fig. a, A.

CAMPANULARIA VOLUBILIS, *Alder, North. and Durh. Cat. in Trans. Tynes.*
F. C. iii. 125, pl. iv. fig. 7.

Plate XXIV. fig. 2.

STEMS rising at intervals from the stolon, which is some-

* This genus is founded on two Campanularian species of simple habit, bearing a general resemblance to *Clytia Johnstoni* or *Campanularia volubilis*.

times plain, sometimes spirally twisted, and which often sends off free shoots, rather long, *spirally twisted, with a single spherical ring below each calycle**; HYDROTHECÆ rather narrow and deep, of equal width throughout, till within a very short distance of the base, when they suddenly contract, *with about ten shallow, blunt denticles round the margin*; GONOTHECÆ ON short stalks (2 whorls), *flask-shaped, smooth, with a long narrow neck*.

Mr. ALDER was the first to point out that the *Sertularia volubilis* of Linnæus is a distinct species from the *Campanularia volubilis* of Johnston†. In his 'Northumberland Catalogue' he has defined the characteristics of the two forms with his accustomed accuracy both of pen and pencil, and restored to its proper rank one of the prettiest of its tribe.

The *C. volubilis* is a small species, and may be readily known by its spirally twisted (not ringed) stems and the solitary spherule beneath the calyces. The latter, too, are much more cylindrical than those of the allied species, and the denticulation is comparatively minute. The creeping stem has a fashion of detaching itself and casting forth long, delicate, and transparent spiral shoots; when attached it is sometimes smooth.

The neck of the prettily shaped capsules varies considerably in length. They are generally produced but sparingly, and scattered singly along the creeping stem; but I have seen them crowded together in numbers, and forming a dense mass about the base of the calyces.

Hab. On zoophytes from deep water; widely distributed. [Norway (Sars) : off Reikiavik, Iceland, in 100 fathoms,

* "At the bottom of each [cup], where they join the stalk, the microscope discovers to us a very minute spherule or little ball, as in some drinking glasses."—*Ellis*.

† The *Clytia Johnstoni* of the present work.

amongst icebergs, on *Sertularia* (T. H.) : Mingan Islands; Henley Harbour (20–30 fath.), Gulf of St. Lawrence (A. S. Packard, jun.) : Massachusetts (Agassiz).]

2. *C. HINCKSII*, Alder.

CAMPANULARIA VOLUBILIS, var., *Hincks*, Ann. N. H. (2nd ser.) xi. 180.

„ *HINCKSII*, *Alder*, North. & Durh. Cat. in Trans. Tynes. F. C. iii. 127, pl. iv. fig. 9.

Plate XXIV. fig. 3.

STEM generally long, *with two or three rings at the top* (one of which is included in the cup) *and one or two slight twists at the base, the intermediate portion smooth*; HYDROTHECÆ deep and *very large, with parallel sides, lined at regular intervals longitudinally, the margin castellated, or cut into square-topped denticles, which are slightly hollowed out above*; GONOTHECÆ of a much elongated ovate form, becoming narrower towards the upper extremity, which is truncate, divided by transverse rings into numerous (10–12) rounded and not very prominent segments, and attached by a short, smooth stalk.

C. HINCKSII is remarkable for its large, lineated calyces, with a castellated rim which is ornamented with as many as fourteen square-topped denticles. The pedicels vary in size, but are commonly of considerable length.

The reproductive capsules are beautiful objects, very long and slender, almost cylindrical in form, and usually ringed throughout (Woodcut, fig. 18). The spaces between the rings are very slightly convex and are not carinated. In some cases, however, the annulation is almost obliterated, and the capsule is in great measure smooth.

The ova are numerous, and piled up like balls, forming an elongated central mass.

Hab. On zoophytes &c., from moderate depths (10–20 fathoms) to deep water; rather rare.

Fig. 18.



Torbay, in about 8 fathoms; Oban, in about 15 fathoms (T. H.): Northumberland and Durham, on shells and zoophytes from deep water, rather rare (J. A.): Hebrides (A. M. N.): Wick (C. W. P.): Shetland (J. G. J.): north of Ireland, in deep water, common (Prof. W. Thomson).

3. *C. INTEGRA*, Macgillivray.

CAMPANULARIA INTEGRA, *Macgillivray*, Ann. N. H. ix. 465; *Johnston*, B. Z. 109, pl. xxviii. fig. 2.

Plate XXXI. fig. 1.

STEMS long, slender, *twisted*, with two or three spherical rings immediately below the calycle; CREEPING STOLON smooth; HYDROTHECÆ campanulate, wide above, tapering very gradually towards the base, with a plain rim; GONOTHECÆ much elongated, spirally twisted, the volutions

sharply carinated, truncate above, with a plain eireular orifice, below somewhat abruptly attenuated, and attached by a short, smooth stalk.

I HESITATE to identify the *C. lævis* of Couch with this species, although it may possibly be nothing else. He speaks of "the footstalk" as unringed, and dilating gradually into the calycle. The latter part of this description has no application to *C. integra*, nor to any other *Campanularia* that I know of, while the pedicel of the present species has always two or three very marked rings at its upper extremity, and is distinctly twisted below them.

When the capsules, which are profusely developed and of most elegant form, are present, there are few prettier sights of the kind than a colony of this species.

Hab. Donmouth (Macgillivray) : Hastings (Saunders) (it seems to be common on the south-eastern coast) : Ilfracombe, on red weed ; Filcy (T. H.) : on roots of *Laminariæ* and *Ascidia*, low-water mark, Bamborough (J. A.) : Wiek (C. W. P.) : Belfast Bay.

[*C. integra* occurs in immense profusion on weed from Hamilton Inlet, Labrador, taken up in 15 fathoms. The capsules are in great abundance and of very large size, and the whole aspect of the specimens betokens a congenial habitat. The calycles have their chitinous walls greatly thickened.]

4. *C. CALICULATA*, Hincks.

CAMPANULARIA CALICULATA, *Hincks*, Ann. N. H. for March 1863 (2nd ser.), xi. 178, pl. v. B. ; *Allman*, Proc. Roy. Soc. Edinb. 1857-58.

C. BREVISCYPHIA, *Sars*, Middelhavet's Litt. Faun. 49, pl. i. figs. 12, 13.

CLYTIA POTERIUM, *Agassiz*, N. H. U. S. iv. 297, pl. xxviii.

Plate XXXI. fig. 2.

STEM a simple pedicel of variable length, *with a single*

well-marked ring immediately below the calycle, and merely crenated or faintly annulated from this point to the base; HYDROTHECÆ campanulate, with an even rim, the walls greatly thickened, so as to give the appearance of a double calycle, and projecting inwards towards the bottom to form a diaphragm, beneath which there is a spherical cavity; GONOTHECÆ shortly stalked, of an irregular oval shape, having a somewhat wavy outline, truncate at the top, and with a wide aperture.

WHEN I first described this beautiful species, I was fully persuaded that the calycle was really double, that within the outer wall there was a distinct inner cup, which immediately enclosed the body of the polypite. I now see that this was an error, and that the peculiar appearance which the species presents is due to a remarkable thickening of the polypary. The terms of my former description must therefore be modified; but the name *caliculata* is still sufficiently appropriate.

The cavity of the hydrotheca, which is enclosed by a considerable thickness of transparent chitine, has all the appearance of an inner cup suspended within the true calycle. The illusion is complete. In shape it resembles an inverted hand-bell, the spherical space at the bottom of it representing the *handle*.

The form of the hydrothecæ is liable to some variation. Commonly they are not deep, rather wide at the top, narrowing downwards very slightly, and well rounded-off below; but another type occurs, which is more elongate and tapers off more decidedly, and bears a striking resemblance to an old-fashioned wine-glass.

These two forms are generally mingled on the same specimens. The pedicels are not of such a uniform and moderate length as I formerly supposed; they have sometimes as few as 9 or 10, and sometimes as many as 20 crenations or more.

The *C. breviscyphia* of Sars seems to have been founded on examples of *C. caliculata* with more elongated stems and somewhat shorter calyces than those from which the original description was taken. I have little hesitation in identifying it with the present species. Sars has obtained specimens of *C. caliculata* near Bergen on which the pedicels had more than 30 rings—or, rather, “slight waves,” as Agassiz more accurately styles them. As in other species, there seems to be much variability in this portion of the structure.

The newly formed calycle is covered by a convex cap, shaped like a watch-glass, which the polypite pushes off when fully developed.

The calyces are very tremulous, owing to the deep constriction of the stem to form the spherule on which they rest, and are soon detached after the death of the polypite.

The reproductive capsules (female) contain two sporosacs, a large one above and a smaller one below—or sometimes only one, which occupies, when its contents are matured, the greater portion of the cavity. Four branched gastrovascular canals spring from the base of it, amongst the ramifications of which the ova are placed (Plate XXXI. fig. 2 *d*). The capsule was first described by Sars (‘Mediterranean Littoral Fauna,’ p. 50); and its structure and the development of its contents have been thoroughly investigated by Allman and Agassiz*. The latter has frequently seen a portion of the contained mass of planules forced out of the capsule, still enclosed in the sac, and remaining attached externally.

The planule is ovate, and clothed with vibratile cilia.

* In Agassiz’s great work on the Natural History of the United States. this species is described and figured as *Clytia poterium*. It is to be regretted that this distinguished author did not pay more attention to the European forms before naming his American Hydroids, many of which, I believe, are identical with British species.

I am indebted for my first knowledge of this species to Mr. R. S. Boswell, who many years ago showed me specimens of it exquisitely mounted, according to a method of his own, so as to display the polypites.

Hab. On the red algæ chiefly (*Delesseria sanguinea* &c.), near low-water mark and in moderate depths; not common.

Pegwell Bay, near Ramsgate (R. S. Boswell): Old Head of Kinsale, co. Cork (R. Allman): Ilfracombe; Swanage, Dorset (T. H.): Courtmasherry Harbour, co. Cork (G. J. A.): Jersey (A. M. N.).

[Messina (var. *breviscyphia*, Sars); Bergen (Sars): Hamilton Inlet, Labrador, 15 fathoms, on red weed (T. H.): Massachusetts, "almost invariably attached to seaweeds, or to the stem of other hydroids" (Agassiz): Nova Scotia (*teste* A. Agassiz.)]

Section *b.* Branched and with compound stem.

5. *C. VERTICILLATA*, Linnæus.

"HORSE-TAIL CORALLINE WITH BELL-SHAPED CUPS," *Ellis*, Corall. 23, pl. xiii. figs. *a*, *A*.

SERTULARIA VERTICILLATA, *Linn.* Syst. 1310; *Palas* Elench. 115.

CLYTIA VERTICILLATA, *Lamx.* Cor. flex. 202.

HALECIUM VERTICILLATUM, *Oken*, Lehrb. Nat. 92.

CAMPANULARIA VERTICILLATA, *Lamk.* An. s. V. (2nd ed.) ii. 131; *Johnst.* B. Z. 112, pl. xxvi. figs. 3, 4.

CAPSULARIA VERTICILLATA, *Gray*, B. M. Radiata, 87.

Plate XXXII. fig. 1.

STEMS erect, *composed of many parallel tubes*, irregularly branched, obtuse at the top; *branches compound, cylindrical*; HYDROTHERCÆ bell-shaped, rather large and deep, expanding slightly and very gradually upwards, with about 12 pointed denticulations on the margin, borne

on pedicles, which are more or less annulated at the top and bottom, patent, and arranged in whorls at regular intervals; GONOTHECÆ flask-shaped, smooth, with a narrow neck, and very shortly stalked.

THE term "*equisetiform*," which Ellis has applied to this species, gives an admirable idea of the mode in which the pedicels are disposed on the stem and branches. They form equidistant whorls, and "give the whole very much the appearance of the plant called Horsetail or *Equisetum*." There are about 5 to each whorl. The calyces are of a thin and delicate texture. *C. verticillata* sometimes attains a luxuriant growth, and is much and variously branched.

Hab. In the coralline zone, on shells &c.; common. It is taken up in immense quantities by the trawlers on the south-west coast.

[Tromsö, rare; North Cape, common in 30–50 fath. (Sars): Henley Harbour, Labrador, in 20 fath. on a pebbly bottom (A. S. Packard, jun.): coast of La Charente-inférieure, Bay of Biscay (Beltremieux).]

Section c. With branching stems [*Laomedea*, Lamx.]

6. *C. FLEXUOSA*, Hincks.

LAOMEDEA GELATINOSA, var. *a*, *Johnston*, B. Z. 105, pl. xxv. figs. 3, 4; *Couch*, Corn. Faun. 39, pl. x. fig. 2.

LAOMEDEA FLEXUOSA, *Hincks*, Devon and Cornw. Cat., Ann. N. H. (3rd ser.) viii. 260; *Allman*, Ann. N. H. for May 1864.

Plate XXXIII.

STEM filiform, *flexuous*, simply pinnate or irregularly branched, of a light horn-colour, ringed at the base and above the origins of the branches; HYDROTHERCÆ alternate, *large, cup-shaped, wide above, the sides sloping off somewhat abruptly towards the base, with a plain rim, and borne on rather long, ringed pedicels* (6–7 rings or more), which are given off at each bend of the stem; GONOTHECÆ (female)

axillary, *very large*, elongate, *oval*, smooth, *rather wide and truncate at the top*, attached by a short, ringed stalk (3-4 rings), and containing numerous sporosacs; male smaller; POLYPITES with the tentacles slightly webbed.

C. FLEXUOSA, which was included under *Obelia gelatinosa* by Johnston, is one of the commonest of our littoral zoophytes. In amazing profusion it spreads over a considerable portion of the littoral zone, now half buried in the mud beneath the loose stones, now covering with its delicate forests the sides of the tidal pools filled with the most pellucid of water. It forms also a dense undergrowth on the surface of the larger rocks, beneath the pendent weed, where it is left flattened down and half dried on the recession of the sea. A beautiful sight it is to see the prostrate forests revive, and waving to and fro with the flux and reflux of the incoming tide. We cease to be surprised at its abundance when we examine the reproductive capsules (female)*, which are of enormous size, as compared with the calyces, and often crowded on the shoots, each one containing a large number of planules. They are also occasionally met with on the creeping stolon.

The tentacles of the polypite are united towards the base by a membrane of extreme tenuity, similar to that which exists in *Campanulina acuminata*. The species is subject to but slight variation. In some situations the shoots have a tendency to run out above into tendril-like fibres. The pedicels which support the hydrothecæ also vary considerably in length, and the ramification is more or less luxuriant; but the flexuous habit, the broad, obconic, and even-rimmed calyx, and the gigantic capsule are constant and striking features.

* The male capsule is much smaller than the female (*vide* Plate XXXIII. fig. *b*), and somewhat different in shape.

C. flexuosa attains a height of about an inch.

Hab. Confined to the littoral region, and extremely common on all parts of our coast.

Shetland, Jersey, Cornwall, Isle of Man, Ireland, &c.

7. *C. ANGULATA*, Hineks.

"Catalogue of Devon and Cornw. Zooph.," Ann. N. H. (3rd ser.) viii. 261, pl. viii.

Plate XXXIV. fig. 1, and Woodcut, fig. 14.

STEM slender, simply pinnate or very slightly branched, *zig-zag*, the spaces between the bends very long, ringed at the base and above the origin of the pedicels, often produced at the extremity into long, tendril-like claspers; HYDROTHECÆ alternate, campanulate, rather deep, tapering gradually downwards, even-rimmed, borne on very long ringed pedicels, which are given off at each flexure, and are slightly attenuated above; GONOTHECÆ irregularly ovate, with a few obscure wrinkles, and occasionally one or two projecting points, terminating above in a short, broad neck, which is somewhat truncate at the top, developed on the creeping stem and attached by a short, ringed stalk (3-4 rings); POLYPITE with about 24 remarkably long and slender tentacles.

Height from $\frac{1}{2}$ to $\frac{3}{4}$ inch.

THIS species may be known by the great length of the internodes, which bend from side to side and form a series of obtuse angles, and of the tapering pedicels that support the ealyeels. They have commonly from 9-12 rings, and sometimes nearly 20; occasionally there is a smooth portion about the middle of the pedicel. The tendril-like prolongation of the stem is also a striking feature; it is often of great length, much thickened above, and strongly annulated towards the lower end. Specimens occur in

which the stem is only about $\frac{1}{8}$ of an inch in height, with two or three calyces, while the *tendrils* are fully $\frac{1}{2}$ an inch long.

The capsules, so far as I have seen, are never borne on the stem; they are somewhat variable in shape. All the specimens that I have hitherto examined are on the *Zostera*. The creeping stem runs along the leaf, giving off erect shoots at short intervals, and between them the capsules are ranged; they commonly spring from the side of the stolon and are therefore recumbent on the surface of the leaf.

Hab. On *Zostera marina*. Ramsay, Isle of Man; Torbay (T. H.): Jersey (abundant on *Zostera*) (A. M. N.): Youghal (Miss Ball): North of Ireland (Prof. W. Thomson).

8. C. NEGLECTA, Alder.

LAOMEDEA NEGLECTA, Alder, Northumb. & Durh. Cat. in Trans. Tynes. F. C. iii. 123, pl. v. figs. 1, 2; Hincks, Devon & Cornw. Cat., Ann. N. H. (3rd. ser.) viii.

Plate XXX. fig. 2.

ZOOPHYTE *delicate and of very humble growth*; STEM *fili-form, subflexuose, simply pinnate*, annulated (4–7 rings) above the origin of each pedicel, and sometimes slightly ringed below; HYDROTHECÆ *alternate, narrow and deep, borne on ringed pedicels, with about 8 bimucronated denticles round the margin*; GONOTHECÆ *pyriform*, axillary or borne on the pedicels, with a short, ringed stalk, —ova matured in an external marsupium; POLYPITE with 15–16 slender tentacles.

IN its usual condition this is a very minute species, attaining a height of about $\frac{1}{10}$ of an inch, very sparingly branched or perfectly simple, each stem bearing a single

calycele. In Devonshire, however, I have found it of much larger size (about $\frac{3}{4}$ of an inch high), more decidedly branched, and bearing the reproductive capsules in abundance. They are produced in the axils; and sometimes one is present a little above them on the pedicel that supports the hydrotheca. They contain one sporosac, which buds from the side of the upper part of the axial column, and ultimately becomes terminal. It bears two or three ova, and is at last carried up and pushed through the orifice of the capsule, becoming invested with a thick gelatinous covering, and forming a nest in which the eggs are hatched into planuloid embryos.

The margin of the calycele in *C. neglecta* is of extreme tenuity, and it is a matter of no slight difficulty to define the subturreted crenulations.

Hab. On the underside of stones, between tide-marks, and on other zoophytes &c., from inshore to the coralline region; common.

9. *C. EXIGUA*, Sars.

CAMPANULARIA, *Gegenbaur*, Generationswechsel bei Medus. u. Pol. 35 (note), pl. i. figs. 5, 6.

LAOMEDEA EXIGUA, *Sars*, Middelhavet's Litt. Faun. 50.

Plate XXVIII. fig. 2.

STEM *very delicate, slightly flexuous*, giving off at each bend simple pedicels, ringed at the base and upper extremity (the intermediate space being smooth), which support the calyces; HYDROTHECÆ *very small, regularly funnel-shaped, with an even rim*; GONOTHECÆ axillary, elongate, *smooth, somewhat fusiform*.

Height about $\frac{1}{4}$ inch.

THIS very minute species was first described and figured by

Gegenbaur, who also investigated its reproductive history, but did not name it. The calyces are almost triangular, with perfectly straight sides ("ohne Ausbuchtung"). The pedicels are described by Gegenbaur as only annulated at the top and bottom, the central portion being plain; but this is probably not a constant character. The stem is ringed at the base and above each branch. The capsules are elongate, tapering off towards the base, and narrowed for a short distance below the truncate extremity; they are filled with numerous sporosacs.

Hab. On zoophytes, Swanage, Dorset (T. H.).

[Messina (Gegenbaur and Sars): Belgium, where it attains a rather large size (Van Beneden).]

10. *C. DECIPIENS*, T. Strethill Wright.

"Observat. on Brit. Zooph.," Journ. of Micr. Sci. (N.S.) iii. 49, pl. v. fig. 9.

ZOOPHYTE *minute*; STEM filiform, flexuous, annulated with about 5 rings above the origin of the pedicels which support the hydrothecæ; HYDROTHERCÆ *widening rapidly towards the top, with even, double rims*, borne on ringed pedicels; POLYPITES with about 16 tentacles.

"THIS pretty little *Laomedea* resembles much the *L. neglecta* of Alder, except that the margin of the cell is even and has the appearance of being double for about half its length from the rim, though, from the extreme delicacy of the cell, this character is only made out with difficulty." (*Wright*.) The reproduction is described as exactly similar to that of *Opercularella lacerata*, except that the marsupium of *C. decipiens* contains only three ova, while that of *O. lacerata* contains six or eight.

A more minute diagnosis is much to be desired. So

slight a description, unaccompanied by any figure but one of a single calycle, is not sufficient for the purpose of identification.

Hab. Firth of Forth (T. S. W.).

Species referred provisionally to this genus.

C. (?) GIGANTEA, Hincks.

“On new British Hydroida,” Ann. N. H. for October 1866 (3rd ser.) xviii.
297.

Plate XXXV. fig. 1.

STEMS delicate, *of a very light horn-colour and papyraceous texture*, annulated at the base and below the calycle, *irregularly and sparingly branched*; branches erect, copies of the primary shoot, sometimes themselves branched; HYDROTHECÆ *of enormous size, deeply campanulate, very wide at the top and for some way below it, and then tapering off gradually, length about double the greatest width, the rim cut into broad and blunt teeth*; GONOTHECÆ unknown.

Height about an inch.

THIS well-marked form may be at once recognized by the extraordinary size of its calycles, which are very much larger than those of any other known species. They vary somewhat in breadth, but their dimensions are always gigantic for the tribe.

The general habit of growth resembles that of *Gonothyræa gracilis* (Sars). The primary shoot sends off one or more branches, generally at a considerable height above the base, each of which is a pretty exact copy of itself. These branches are somewhat constricted at their origin, and closely ringed for some distance above it; they ter-

minate in a single calycle. Occasionally the branching is carried further ; but in all the specimens which I have seen it is simple and scanty. Below the calycle there are several well-marked, somewhat compressed rings. The stems are singularly tender and transparent.

I am indebted to Prof. Wyville Thomson for the specimen from which this description is taken. Unfortunately he was unable to study the reproduction, so that the species can only be provisionally placed.

Hab. Lamlash Bay, Arran, on shells (Prof. Wyville Thomson).

C.? FRAGILIS, Hincks.

LAOMEDEA FRAGILIS, *Hincks*, Ann. N. H. for January 1863, xi. (3rd. ser) 46, pl. ix. fig. 3.

? CAMPANULARIA ELONGATA, *Van Beneden*, Faune Litt. de Belgique, Polypes, 164 & 150, fig. 6.

Plate XXXII. fig. 3.

ZOOPHYTE *very minute* and delicate ; STEM *flexuose, giving off alternately, at each flexure, ringed and tapering pedicels, which support the calycles*, annulated above the origin of each pedicel ; HYDROTHECÆ *much elongated and very narrow, attenuated below, with an even rim*. Reproduction unknown.

Height about $\frac{1}{8}$ inch.

THIS species is smaller and more delicate even than the *C. neglecta* (Alder), and it is as graceful in form as it is fairy-like in size. The stem is decidedly flexuous, and the calycles are remarkable for a combination of (comparatively) great length and narrowness. When the polypite is extended, only the proboscis and the wreath of tentacles are beyond the orifice.

I suspect that the *C. elongata* of Van Beneden is iden-

tical with the present species. He has figured a single hydrotheca, which corresponds exactly with that of *C. fragilis*; and his description, in all important points, agrees with the one just given. He has noticed especially the very minute size*.

Hab. In pools on the lower ledges of the Capstone, Ilfracombe, forming miniature groves on the underside of stones (T. H.).

[(*C. elongata*) Coast of Belgium (Van Beneden).]

C.? RARIDENTATA, Alder.

Suppl. North. and Durh. Cat. in Trans. Tynes. F. C. v. 238, pl. x. fig. 5.

Plate XXVI. fig. 2.

STEM short, simple, *rising from a slight bulbous expansion of the stolon, ringed above and below*, and bearing a single calycle; HYDROTHECÆ *rather long and narrow, tapering a little towards the base, and with 5 or 6 deep, pointed crenulations round the margin*; GONOTHECÆ unknown.

Height $\frac{1}{20}$ inch.

A MINUTE species, with a slender calycle and a very small number of marginal denticles.

Dr. Strethill Wright has succeeded in rearing a Campanularian from the planules of *Thaumantias inconspicua* (Forbes) which bears a close resemblance to the present species†. It is not improbable that *C. raridentata* may prove to belong to the same genus.

Hab. On other zoophytes from deep water, Cullercoats,

* "Cette espèce est tellement petite qu'avec une bonne loupe ordinaire on la distingue à peine; elle nous avait longtemps échappé."—*Polypes* (1866), p. 164.

† Journ. of Microscop. Science for October 1862, pp. 221 & 308.

occasionally (J. A.): on coralline &c. between tide-marks, Torquay; on zoophytes, amongst the Brixham trawl-refuse, not uncommon; Swanage Bay, Dorset, common in 5-7 fathoms (T. H.).

Genus LOVÉNELLA, *Hincks*.

Der. Named after the distinguished Swedish naturalist, Lovén.

GENERIC CHARACTER.—*Stems simple or slightly branching, rooted by a thread-like stolon; hydrothecæ turbinate, elongate, crowned with a distinct, conical operculum, composed of many convergent segments; polypites with a large and prominent proboscis.*

Reproduction unknown.

THIS genus is distinguished from its allies by its long (but not tubular) operculated calyces. Its polypite is of the same type as that of *Campanularia*.

L. CLAUSA, Lovén.

CAMPANULARIA CLAUSA, *Lovén*, Bidrag till Kännedomen af Släktena *Campan.* och *Syncoryna*, 3 (note).

Plate XXXII. fig. 2.

STEMS *simple or very sparingly branched, with a few rings at the top and bottom, the intermediate portion crenated or wavy; branches short, simple, erect, supporting a single calyx; HYDROTHECÆ hyaline, very long and slender, tapering off gradually below, the rim cut into shallow crenations, which correspond with the segments of a turret-shaped operculum, composed of about 8 pieces that converge and meet in a point; POLYPITE with about 15 tentacles; GONOTHECÆ unknown.*

THIS beautiful species was characterized by Lovén incidentally in a note to his famous paper on *Campanularia* and *Syncoryna*. It had not, I believe, attracted the notice of any subsequent author; and supposing it to be new to

science, I described it at the meeting of the British Association in 1864 from Devonshire specimens, and gave it the very name which the Swedish naturalist had already bestowed upon it.

The species is at once known by its remarkably long, slender, and graceful calyces, with their turret-like opercula. The habit is comparatively simple, the primary shoots occasionally bearing a single short branch. The hydrothecæ are much produced and attenuated below, and the space between the diaphragm on which the polypite rests and the base is unusually great (Woodeut, fig. 19).

Fig. 19.



Hab. On stones, dredged off the Oar Stone, at the entrance to Torbay, in about 10 fathoms (T. H.).

[On *Fuci* from stony ground, off the coast of Sweden (Lovén).]

Genus THAUMANTIAS, *Eschscholtz**.

THAUMANTIAS, Forbes (in part), Brit. Naked-eyed Medusæ, 41; Gegenbaur, Versuch. einer Syst. d. Medus., Zeitsch. für wissenschaft. Zool. viii. 237.

GENERIC CHARACTER.—*Stem simple (or branched?), rooted by a thread-like stolon; hydrothecæ campanulate; polypites with a prominent funnel-shaped proboscis; reproduction by free medusiform zooids.*

Gonozooid: Umbrella hemispheric; manubrium 4-lipped; radiating canals 4; marginal tentacles numerous; sporosacs in the course of the radiating canals; lithocysts wanting.

THE *Thaumantias* of Eschscholtz was founded on the *Medusa hemisphærica* of Gronovius, a species which is

* Syst. der Acaleph. p. 103.

destitute of lithoeysts. Forbes has adopted it, and made it include a number of forms, generically distinct, of which some are referable to *Obelia* and *Clytia*. Gegenbaur has properly retained the name for the section that agrees with the type species in not having lithoeysts.

Only the reproductive phase was known until Dr. Wright succeeded in rearing from the egg the polypites of *T. inconspicua*, and thus determining the position of the genus.

I see no reason for withdrawing *Thaumantias* from the family of the Campanulariidae.

T. INCONSPICUA, Forbes.

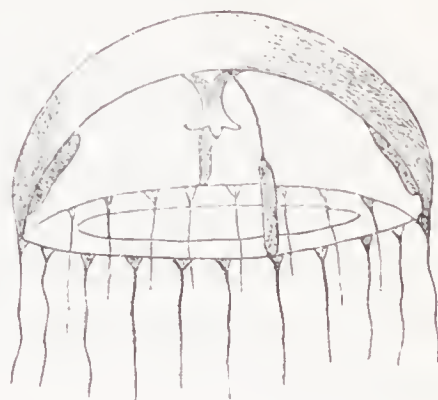
Monograph of the Brit. Naked-eyed Medusæ, 52, pl. viii. fig. 3; *T. S. Wright*, Journ. of Mier. Science (N. S.), ii. 221 & 308.

Woodcut, fig. 20.

STEM simple, ringed at the base and immediately below the calyele, or sometimes throughout; HYDROTHERÆ with from seven to nine denticulations on the margin; GONOTHERÆ unknown.

GONOOID.—UMBRELLA smooth and colourless, measuring about $\frac{3}{4}$ inch across; MANUBRIUM narrow, quadrangular, and of a yellow colour, with lanceolate lips; MARGINAL TENTACLES increasing in number with age (16–40), springing from small pale-yellow bulbs, with a faint tawny spot; SPOROSACS long and linear, and of a faint lilac or greenish hue, with a central fulvous line.

Fig. 20.



DR. WRIGHT describes the trophosome as closely resembling that of *Campanularia raridentata* (Alder). The annulation

of the stem varied amongst the specimens which he succeeded in rearing; in some cases it extended throughout, in others it was confined to the top and bottom. In some of the young zoophytes the ringing at the base "was preceded by a slight dilatation;" the denticulations on the margin of the calycul were usually seven in number. The mature trophosome has yet to be observed.

Forbes gives the number of tentacles on the free zooid at from 16 to 20; but he adds that between each pair there is a rudimentary marginal tubercle, which would no doubt be developed into a perfect tentacle. There may, perhaps, be a still further increase in number.

Hab. Hebrides, common (Forbes): Firth of Forth (T. S. W.).

Genus GONOTHYRÆA, *Allman*.

Der. γόνος, offspring, and θυραῖος, outside the door.

LAOMEDEA, Lamouroux (in part).

GENERIC CHARACTER.—*Stem erect and branched, rooted by a thread-like stolon; hydrothecæ campanulate and hyaline; polypites with a prominent contractile proboscis; reproduction by fixed medusiform sporosacs, which are furnished with a circle of filiform tentacles, and, when mature, become extracapsular, and are borne on the summit of the gonotheca.*

THERE is nothing to distinguish this genus from *Campanularia* or *Obelia* but the structure and history of the sexual zooids, which exhibit some very interesting peculiarities. They are medusiform, but never become free: the generative products are developed as in an ordinary sporosac; but before their liberation the gonophore is

carried upwards by the growth of the axial column, and at length is pushed beyond the orifice of the capsule, and remains attached externally until the contents are matured and discharged, when it withers away. The gonozooid in this genus combines to some extent the characters of the free and fixed forms; it links the one to the other, and shows the impossibility of separating them structurally by any hard line of demarcation.

1. G. LOVÉNI, Allman.

"SEA-THREAD CORALLINE," *Ellis*, Corall. pl. xii. C, and xxxviii. B.

CAMPANULARIA DICHOTOMA, *Lister*, Phil. Trans. 1834; *Van Beneden*, Faune Litt. de Belg. Polypes, 156, pl. xv. figs. 1-4.

„ GENICULATA, *Lovén*, Wiegmann's Archiv, 1837; *Schultze*, Müller's Archiv, 1851; *Van Beneden*, Mém. sur les Campan. 34, pl. iii. figs. 1 & 6'.

LAOMEDEA DICHOTOMA, *T. Stretchill Wright*, Edinb. New Phil. Journ. (N. S.) for Jan. 1859.

„ LOVÉNI, *Allman*, Ann. N. H. for August 1859.

GONOTHYRÆA LOVÉNI, *Allman*, Ann. N. H. for May 1864.

Plate XXV. fig. 2.

STEM erect, *flexuous, irregularly branched*, annulated above the origin of the branches and polypiferous ramuli; HYDROTHERCÆ alternate, *deeply campanulate, narrow, the margin with 10 small and blunt denticles*, borne on short ramuli, which are ringed throughout; GONOTHERCÆ broad and truncate at the top, tapering off to the base (*obconic*), supported on short annulated stalks, *axillary*, carrying on the summit, when mature, from 2 to 5 of the extra-capsular sporosaes.

THE history of this species is interesting. Its peculiar mode of reproduction was noticed by Ellis, who has given an excellent figure of it, but identifies it with his *Sea-thread Coralline*. Lister, in his well-known paper in the 'Philosophical Transactions' (1834), described the male

organs, but left the question of specific distinctness untouched. In 1836, Lovén published an account of the female, accompanied by admirable figures, which is of the highest value; but he wrongly referred it to the *Campanularia geniculata*. Schultze, in turn, investigated its history, adopting Lovén's name for it. At a later period, Dr. Strethill Wright recognized its claims to specific rank, and gave a detailed account of its reproduction, but retained for it the name of *Laomedea dichotoma*, which belongs to another well-marked form. Alder suggested its separation from *Laomedea flexuosa*, with which Allman had at first identified it; and the latter subsequently raised it to specific and then to generic rank, and completed the interpretation of its history. Few species have been privileged to receive the special attention of so many distinguished naturalists.

G. Lovéni ordinarily grows in tree-like tufts, much and irregularly branched, and attains a height of about half an inch. Prof. Allman, however, mentions a large variety which is three or four inches high, and forms "long, lax tufts."

In the absence of the capsule, the best distinctive mark is to be found in the shape of the calyche, which is rather deep and slender, contrasting strongly in this respect with that of *Campanularia flexuosa*, perhaps its nearest ally, and has in addition a denticulated rim. The teeth are small and blunt, and very readily escape observation.

The tentacles on the female sporosae are well-developed and vary in number; on the male they are smaller and less numerous.

Hab. On the fronds of the larger seaweeds at low-water mark, and occasionally on stones, in tide-pools. Brighton (Lister): Dartmouth and Torquay, on *Fucus*; near Dunolly Castle, Oban, in profusion on weed and

stones (T. H.): on stones between tide-marks, at Cullercoats (J. A.): Cramond Island, Firth of Forth, on *Fucus vesiculosus* (G. J. A.): Shetland (A. M. N.): Carrickfergus, on weed and wood close to low-water mark; Monkstown, near Cork, on the pier (Wyville Thomson).

[Coast of Belgium (Van Beneden): Sweden (Lovén).]

2. G. GRACILIS, Sars.

LAOMEDEA GRACILIS, Sars, Beretning om en Zoolog.-Reise i Lofoten og Finnmarken, 18; Middelhavet's Littoral-Faun. 51, pl. ii. figs. 1-4.

GONOTHYRÆA GRACILIS, Allman, Ann. N. II. for May 1864.

Plate XXXVI. fig. 1.

STEM *very slender, straight, giving off branches sparingly and at irregular intervals*, ringed at the top and bottom and above the origin of the branches, which resemble the primary stock, and are frequently in their turn branched; HYDROTHECÆ *much elongated, campanulate, slender, the margin with about 12 long, pointed denticles*; GONOTHECÆ *subcylindrical, smooth, the upper extremity truncate, tapering off below*, attached by a ringed peduncle (5 or 6 rings), and borne on the stems and creeping stolon.

THE branching of this species is peculiar. In the specimens that I have examined, the primary stem bears a single shoot, which has the appearance of growing *upon* it rather than out of it, and this in its turn bears another precisely similar to itself. The branching is carried much further in well-grown examples, as may be seen in Sars's figure. Sometimes the branches are separated by considerable intervals; sometimes two spring from opposite points on the stem.

There are two rings immediately below the calycle, and at the base of both main stem and branches; and above the origin of the latter there is an annulated space.

The calyces are of a most elegant form, deep and narrow, tapering off gradually towards the base, but having the sides parallel for the upper two-thirds of their length.

The capsules are borne on the creeping fibre as well as on the stem, and not exclusively on the latter as stated by Sars; they are longer than the calyces, but slenderer, somewhat narrowed towards the truncate top, of a produced oval shape below, tapering off towards the base.

Sars has described the female gonozooids. The sporosacs, when attached to the top of the capsule, are furnished with a circle of short tentacles, and contain two ova.

Hab. On the tests of Ascidians, sponge, and zoophyte; dredged in Birterbuy Bay, Connemara (G. S. Brady).

[Bergen, attached to *Laminaria saccharina*, not rare (Sars). The same naturalist describes a form found at Messina, which he regards as a variety of the above. It differs from it in having somewhat shorter and broader calyces, with smaller denticles on the margin.]

Referred provisionally to this genus.

G. ? HYALINA, Hineks.

"On new British Hydroida," Ann. N. H. xviii. (3rd ser.) 297.

Plate XXXV. fig. 2.

SHOOTS *densely clustered* on the creeping stolon, *tall and much branched*; MAIN STEMS *very slightly flexuous*, of a deep horn-colour below, *becoming white and very delicate towards the upper extremity*, giving off branches at each bend, strongly annulated at the base and above each division; *branches erect, flexuous, very tender and hyaline, sometimes of great length and much ramified*—a single calyx or a branch springing from each axil; HYDROTHECÆ *alternate, much elongated, slender, of very thin*

texture, with nearly parallel sides for two-thirds of their length, and then tapering off to the base, borne on ringed pedicels, the rim cut into numerous shallow denticles of castellated form, slightly indented at the top; GONOTHECÆ axillary, irregularly ovate, flattened at the top, and supported on a ringed stalk.

Height about 2 inches.

I PLACE this fine species provisionally in the genus *Gonothyræa*. The reproduction has not been traced; but, from the structure of the capsule, I have little doubt that this will prove to be its right position. It is difficult to give a concise, and at the same time accurate, description of the form of the gonotheca; it is long, truncate above and tapering below, straight on one side and curved outwards on the other.

The ramification is irregular and luxuriant; branches are given off at each of the slight flexures of the stem, but they vary much in length and complexity; their growth is erect, so that the shoots are comparatively narrow and slender.

A very striking feature of the species is the remarkably tender and hyaline character of the branches and of the extremities of the main shoots, which are of a most delicate whiteness.

There is very great variation in the length of the pedicels supporting the hydrothecæ, the number of rings ranging from 4 or 6 to nearly 20. The calyces are large and very graceful in their proportions.

Hab. Profusely investing *Tubularia*, *Halecium halecinum*, &c. from Shetland, and, I believe, from deep water. I am indebted for my specimens to Mr. Jeffreys, who has so energetically and thoroughly explored the Shetland seas with the dredge, and who has not forgotten his brother naturalists while attending to his own special department of the science.

Family II.—Campanulinidæ.

HYDROTHECÆ *ovato-conic, pedicellate*; POLYPITES *cylindrical, with a small conical proboscis*.

IN this family the campanulate calycle disappears, and the polypite is of the long, slender, cylindrical type, taking its origin at the very base of the hydrotheca and terminating above in a short, conical proboscis, instead of the large trumpet-shaped organ which belongs to the true *Campanulariida*.

Genus CAMPANULINA, *Van Beneden*.

Der. From *Campanula*, a bell.

GENERIC CHARACTER.—*Stem simple or branched, rooted by a thread-like stolon; hydrothecæ produced and pointed above; polypites cylindrical, with webbed tentacles; reproduction by free medusiform zooids, a single one of which is contained in each capsule.*

Gonozooid: Umbrella (at the time of liberation) deep bell-shaped; manubrium short and 4-lipped; radiating canals 4; marginal tentacles 2 or 4, with bulbous bases; lithocysts 8, borne on the margin of the umbrella, one on each side of the primary tentacles.

THE medusiform zooid in its earliest stage bears a general resemblance to that of *Clytia*, and subsequently passes through much the same course of development. The tentacles and lithocysts increase in number; and the umbrella, which is at first deep bell-shaped, becomes more and more depressed, and finally assumes the shape of a flattened segment of a sphere. These changes have been observed by A. Agassiz in the *Oceania languida*, which is no doubt the reproductive zooid of a member of the present genus. The tentacles in this species increase from two to about forty.

1. C. ACUMINATA, Alder.

CAMPANULINA TENUIS, *Van Beneden*, Un mot sur le mode de Reproduct. des An. infér., Bulet. de l'Acad. Roy. de Belgique, xiv. no. 5, fig. 6; Faune Litt. de Belg. Polypes, 174, pl. xiii.

LAOMEDEA ACUMINATA, *Alder*, North. & Durh. Cat. in Trans. Tynes. F. C. iii. 124, pl. v. figs. 5-8; *T. Strethill Wright*, Edin. N. Phil. Journ. for Jan. 1858, 108, pls. i. and ii.

WRIGHTIA ACUMINATA, *Agassiz*, N. H. U. S. iv. 354.

Plate XXXVII.

STEM *slender*, more or less branched, *annulated*, the annulations strongest at the base and becoming fainter or disappearing towards the calycle; *branches given off a little below the calycles, and copies of the primary shoot*; HYDROTHECÆ thin, *membranous, finely striated longitudinally, elongate pod-shaped, squared below and tapering to a fine point above*; GONOTHECÆ *very large, cylindrical, smooth, supported on long peduncles*, developed on the stems, generally near the base, or on the stolon; POLYPITES very extensile, with about 20 muricated tentacles, united for about $\frac{1}{6}$ of their length by a membranous web.

GONOOIDS pale-emerald green*; UMBRELLA subhemispherical, becoming mitrate during contraction, covered with large thread-cells, more especially about the middle and upper parts; MANUBRIUM quadrangular; TENTACULAR BULBS ringed with deep-blue, destitute of ocelli.

VAN BENEDEN was the first to examine and figure this interesting form, so long ago as 1847. He named it *Campanulina tenuis*, constituting a new genus for its reception, and taking the web which unites the basal portion of the tentacles as the principal distinctive character. He gives, however, no detailed description, and his figure does not enable us to recognize the species which he had in view. Mr. Alder has determined its identity with his own *Laomedea acuminata* from an examination of specimens trans-

* "Aussi belles de couleur que les plus belles émeraudes."—*Van Beneden*.

mitted by Van Beneden. While the Belgian naturalist's genus is retained, there can be no doubt that Alder's specific name is entitled to precedence, as he has given us the first full diagnosis and an admirable figure. Dr. Strethill Wright's valuable observations on the reproductive zooid complete the history of this species.

Mr. Alder remarks that the polypite, "when extended, stretches far beyond the cell, the latter adhering closely to it and becoming cylindrical;" it frequently changes form. The tentacles are alternately elevated and depressed, so as to form two circles. The beautiful web which unites their bases is "studded with thread-cells of very large size, ranged along each side of the tentacles" (*Wright*). (Woodcut, fig. 21.) The stem is sometimes

Fig. 21.



simple, bearing a single polypite only; but in other cases it is repeatedly branched, and "is transformed into a more or less bushy shrub, covered with polypites, and rarely bearing a large Medusa-bud, which is generally developed from the first stem" (*Wright*). The hydrotheca is extremely membranaceous and yielding, becoming

still more delicate towards the top, where it collapses and is folded together and creased so as to form a conical apex, which serves the purpose of an operculum. Mr. Alder describes the margin as slightly crenulated. I believe, however, that there is no true crenulation, but that the appearance is due to the points formed by the folds of the membrane.

The capsules make their appearance, according to Van Beneden, in the month of June. I have only seen *C. acuminata* alive in an aquarium, where it covered profusely a deserted univalve shell; and I have seldom witnessed a more remarkable display of Hydroid beauty.

Hab. On an old shell of *Fusus antiquus* from deep water, Cullercoats (J. A.): on an old oyster-shell from the Firth of Forth (T. S. W.).

[Coast of Belgium, on shells, stones, and weed (Van Beneden).]

2. *C. REPENS*, Allman.

"Notes on the Hydroida," Ann. N. H. for July 1864.

Plate XXXVIII. fig. 1.

STEM simple or branched, distinctly annulated, branches alternate; HYDROTHECÆ conical, closed by a membranous operculum, formed of deep and acute convergent segments; GONOTHECÆ large, obconic, slightly gibbous at one side near the base, with a short ringed stalk, borne on the creeping stolon and occasionally on the stem; POLYPITES very extensile, with about 16 tentacles alternately elevated and depressed, and united at the base by a very shallow web.

GONOOID (at the time of liberation) with four very extensile tentacles, which are nodulated by clusters of thread-cells.

THIS species differs from the last in the following parti-

culars:—Its calycle is “crowned by long converging segments, which on the retreat of the polypite form a true opereulum,” while in *C. acuminata* it is merely “continued by a delicate, collapsile, and undivided membrane;” the web that unites the bases of the tentacles is much more slightly developed; and the gonozoid has four tentacles, instead of two, at the time of its escape from the capsule.

Hab. Investing the surface of Sertularian Hydroids from about 5 fathoms in the Firth of Forth (G. J. A.).

3. *C. TURRITA*.

Plate XXXVI. fig. 2.

STEM distinctly ringed throughout, *somewhat zigzagged*, bearing short, annulated ramules in groups of two or three at every bend, each of them supporting a polypite; HYDROTHECÆ tall and slender, widening gradually upwards from the base, with an operculum composed of short, convergent segments; GONOTHECÆ broad and subtruncate above, bulging slightly at one side, tapering downwards, shortly stalked, and borne on the stem.

GONOOID closely resembling that of *C. acuminata*.

I AM only able to give an imperfect account of this very pretty species, as I have not had the opportunity of examining specimens. It differs notably from *C. repens* in the shape of the calycles. The segments composing the opereulum are very much shorter in proportion to the length of the hydrotheca than in the latter species. In *C. repens* they are deep and form a tall, acuminate covering, which is about a third as long as the calycle; in *C. turrita* the striking feature is the disproportion between the latter and the shallow operculum. The general habit and the grouping of the ramules also differ in the two forms.

The gonozooid of *C. turrita*, as I learn from Professor Wyville Thomson, who has kindly supplied me with the drawing on which this description is founded, resembles that of *C. acuminata* so closely that it is difficult to distinguish the one from the other. It is slightly broader in its proportions and perfectly colourless. The umbrella is dotted over with large thread-cells.

Hab. Very abundant on *Zostera* (along with *Campanularia angulata*), Holywood, Belfast Lough (Prof. W. Thomson).

Genus ZYGODACTYLA, Brandt.

ÆQUOREA, Péron and Lesueur (in part).

RHACOSTOMA, Agassiz.

GENERIC CHARACTER.—*Stem simple or branching, rooted by a filiform stolon; hydrothecæ with an operculum formed of many convergent and acuminate segments; polypites cylindrical, with the tentacles webbed below. Reproduction by free medusiform zooids.*

Gonozooid: Umbrella (in the adult) more or less hemispherical; manubrium short, with many fimbriated lips; radiating canals very numerous; marginal tentacles very numerous, with bulbous bases; lithocysts borne on the margin of the umbrella.

THE medusiform sexual zooids of several *Zygodactylæ* are known, but in one case only has the polypite been observed. The gonozooids are remarkable for their size; those of *Z. Grænlandica* (A. Agass) sometimes measure as much as fifteen inches in diameter; those of *Z. crassa*, of the same author, are nearly as large.

The number of radiating canals in the adult is very great (about 100); they are progressively developed; and in very young specimens, according to the observations of A.

Agassiz, only four are present. They are developed from the digestive cavity, and gradually extend downwards, opening at last into the circular vessel. Sometimes two or three rudimentary tubes of various lengths are met with between each of the perfect canals. The fimbriated mouth of the manubrium is a striking feature; indeed the whole structure is complex, and there is an extraordinary multiplication of parts. It is curious that the only one of these comparatively gigantic organisms that has been traced to its stock should prove to be the reproductive phase of one of the smallest of the Hydroida.

Though there is so much superficial difference between the adult gonosomes of *Campanulina* and *Zygodactyla*, there can be little doubt that these genera should be ranked in the same family. The trophosomes are identical; and in their earliest condition there seems to be no essential difference between the gonozooids. Those of *Zygodactyla* have probably only four radiating canals at the time of liberation, the number increasing, like that of the tentacles, as they advance to maturity. In *Campanulina* the arms multiply, but the canals seem never to exceed four.

Z. VITRINA, Gosse.

ÆQUOREA VITRINA, Gosse, Devonsh. Coast, 340, pl. xxiii.; T. S. Wright, Journ. of Micr. Science, iii. (N. S.) 45, pl. iv. figs. 1-6.

ZYGODACTYLA VITRINA, Agassiz, N. H. U. S. iv. 361.

Plate XXXVIII. fig. 2.

STEM simple (or branched?); HYDROTHECÆ squared below, and above terminating in many convergent segments; POLYPITES with 12 alternating tentacles, united for about a third of their length by a web; GONOTHECÆ unknown. GONOOID.—UMBRELLA hemispheric or subconic, perfectly colourless; MANUBRIUM wide, traversed by opaque white lines, and with very numerous, narrow, pointed, furbe-

lowed and reflexed lips, reaching almost to the margin of the umbrella; RADIATING CANALS 80-90; MARGINAL TENTACLES white, attenuated, with small bulbs at the base, extremely numerous (as many as 400 in the adult); LITHOCYSTS with from two to five refractile spherules.

THE polypites have only been observed in their earliest stages of growth, and we are ignorant what the perfect form may be. Dr. Wright, having procured specimens of the sexual zooid (the *Æquorea vitrina*, Gosse), succeeded in hatching the ova, and tracing the development of the planules into extremely minute polypites, which he could not distinguish from the hydroid phase of *Campanulina acuminata*. They were quite invisible, however, to the naked eye, and in too immature a state to allow of satisfactory examination.

The gonozooid attains a very large size, being sometimes as much as about six inches and a half in diameter. Mr. Gosse's specimens were much smaller, and only partially developed. The oral lobes and the marginal tentacles, with their attendant lithocysts, in the examples which came under his notice, were much less numerous than in the adult. The latter numbered more than 200, and the former about 20; while in the older individuals examined by Wright there were no less than 400 tentacles and 40 lobes. The umbrella is perfectly translucent, and the radiating canals are described as resembling "bands of frosted or ground glass upon a body of clear glass."

Hab. Ilfracombe (Gosse): Scotland (T. S. W.).

Genus OPERCULARELLA, *Hincks*.

Der. A diminutive form of *Opercularia*, from *Operculum*, a lid.

GENERIC CHARACTER.—*Stem simple or branching, rooted by a thread-like stolon; hydrothecæ ovato-conic, with a cleft border, the segments of which converge to form an operculum;*

polypites long, cylindrical, and with a conical proboscis ; reproduction by means of fixed sporosacs, which (in the female) become extracapsular before the escape of the planules.

THIS genus is constituted for the *Campanularia lacerata* (Johnston), which is identicall with *Campanulina*, so far as the trophosome is concerned, but differs from it widely in its mode of reproduction. Allman ranks it along with *C. syringa* (Johnston) under the genus *Calycella* ; but though these two forms are similar in some respects, their calyces are formed upon a different type, those of *C. syringa* allying it with *Lafoëa*, and those of *C. lacerata* with *Campanulina*.

The operculum of the present genus differs from that of *Calycella* ; it is nothing more than the cleft border of the hydrotheca, which collapses and forms a kind of roof. In *Calycella* it consists of a true lid—a turreted covering or a folded membrane. There is indeed a striking dissimilarity between the hyaline, ovato-conic calyces of *Opercularella*, and the long, tubular calyces, of somewhat dense texture, which distinguish the true *Calycellæ* ; and the points which separate the present genus from the *Lafoëidæ* connect it with *Campanulina*. I believe, therefore, that the natural relationships will be best represented on the whole by the arrangement which I have adopted.

O. LACERATA, Johnston.

CAMPANULARIA LACERATA, *Johnst.* B. Z. 111, pl. xxviii. fig. 3 ; *Van Beneden*, Faune Litt. de Belgique, Polypes, 159, pl. xv. fig. 5–13.

CAPSULARIA LACERATA, *Gray*, Cat. B. M. Radiata, 87.

LAOMEDEA LACERATA, *Hineks*, Ann. N. H. (2nd ser.) x. 86 ; *T. S. Wright*, Edinb. N. P. Journ. (N. S.) for Jan. 1859, pl. iii.

WRIGHTIA LACERATA, *Agassiz*, N. H. U. S. iv. 354.

CALYCELLA LACERATA, *Allman*, Ann. N. H. for May 1864, 31.

Plate XXXIX. fig. 1.

STEM *erect, slender, slightly flexuous*, annulated throughout,

sparingly branched; HYDROTHERCÆ on short ringed pedicels, alternate, *ovato-conical*, the operculum composed of deep, convergent segments; GONOTHERCÆ (female) large, ovate, smooth, on short, ringed stalks, produced near the calyces; (male) subcylindrical.

Height, when mature, from $\frac{1}{2}$ to $1\frac{1}{4}$ inch.

THIS species is commonly found in very humble guise, the creeping stem sending up at intervals short, ringed stalks, which bear a single calycle. In this state it occurs profusely on stones, shells, seaweeds, and other zoophytes. I have a specimen of this form from Torbay, covering the inner surface of a shell, in which the reproductive capsules are produced on the creeping stolon amongst the calyces. In its most highly developed state *O. lacerata* is either bushy or of tall and slender growth; its usual height is about half an inch.

The gonothecæ are produced abundantly; the female are surmounted at a certain stage by a large and conspicuous sac, enclosed in a thick gelatinous envelope, and containing a brood of several planules*. The polypites have about fourteen arms, are slender and graceful, and extend themselves far beyond the top of the calycle.

Hab. Between tide-marks and in moderate depths; not uncommon. St. Ives, Cornwall; Exmouth, in tufts of *Bowerbankia*; Ilfracombe; Isle of Man; Filey, Yorkshire (T. H.): Northumberland (J.A.): Morrison's Haven, Firth of Forth, in profusion (T. S. W.): St. Andrew's (J. Reid): Oban (T. H.): North of Ireland (Prof. W. Thomson).

[Coasts of Belgium (Van Beneden).]

* Dr. Wright was the first to describe the reproductive zooids. *Vide* Edinb. New Phil. Journ. (N. S.) for Jan. 1859.

Family III.—Leptoscyphidæ.

HYDROTHECÆ *ovato-conic*; POLYPITES *cylindrical, with a conical proboscis*; GENERATIVE ELEMENTS *produced in the walls of the manubrium*; LITHOCYSTS *wanting*.

Genus LEPTOSCYPHUS, *Allman*.

Der. from λεπτός, delicate, and σκύφος, a cup.

GENERIC CHARACTER.—*Stem simple or branching, attached by a thread-like stolon; hydrothecæ with an operculum composed of convergent segments; polypites cylindrical, with a conical proboscis; reproduction by free medusiform zooids.*

Gonozooid: Umbrella (at the time of liberation) deep bell-shaped or conical; manubrium of moderate size, pendent from a conical projection from the roof of the umbrella, the mouth with four short capitate tentacles; radiating canals 4, each terminating in a bulb without ocellus, bearing a cluster of two or three tentacles; a single marginal tentacle with a bulbous base in each interradial space; lithocysts wanting.

THE gonozooid of this remarkable genus is identical with the *Lizzia* of Forbes; the trophosome is that of the *Campanulinidæ*. Now the genus *Lizzia* is one that produces the generative elements in the walls of the manubrium, a situation in which they never occur amongst the *Thecaphora*, except in this single instance. If Allman is right in referring to his *Leptoscyphus* the medusiform zooids which he found free in the phial containing it, the present genus stands alone in the suborder.

Claparède has found a *Lizzia* in the development of

which the fixed-polypite element is wanting, and the ova give origin directly to the medusa or natatory polypite; and Allman proposes to retain Forbes's name for this type.

The tentacles of the free zooid of *Leptoscyphus* probably increase in number with age, until each of the eight marginal bulbs bears a cluster of them (Woodcut, fig. 22)*.

Fig. 22.



Lizzia grata (A. Agass.)

In the *Lizziæ* observed by Sars and Forbes, gemmation took place from the walls of the manubrium.

Leptoscyphus is placed in a distinct family on account of the remarkable peculiarities of its gonosome.

L. TENUIS, Allman.

LAOMEDEA TENUIS, *Allman*, Ann. N. H. for Nov. 1859.

LEPTOSCYPHUS TENUIS, *Allman*, On the construction and limitation of Genera among the Hydroida, Ann. N. H. for May 1864.

Plate XXXIV. fig. 2.

ZOOPHYTE minute; STEM geniculate, distinctly annulated;
HYDROTHECÆ with a deeply cleft margin, borne on ringed

* The woodcut represents an adult *Lizzia*: the interradi al clusters are smaller than those at the extremity of the radiating canals.

pedicels having the same diameter as the stem, and springing alternately from the bends; GONOTHECÆ large, cylindrical, with the lower end conical, and the upper broad and truncated, containing a single zooid.

POLYPITES very extensile, with 16 or 18 tentacula.

GONOOID. See the description under the generic character.

THE tentacles of the gonozoid have the thread-cells uniformly distributed over the surface, showing no tendency to an arrangement in distinct groups.

Hab. On the fronds of *Laminaria digitata*, from about 3 fathoms water, off the town of Stromness (G. J. A.).

Family IV.—Lafoëidæ.

HYDROTHERCÆ *tubular*; POLYPITES *cylindrical, with a conical proboscis.*

Genus LAFOËA, Lamouroux.

Der. Named after M. de Lafoye, a botanist and Professor of Mathematics in the College of Alençon.

CALICELLA, Hincks (in part).

GENERIC CHARACTER.—*Stem a simple, creeping, tubular fibre, or erect and composed of many tubes aggregated together, rooted by a filiform stolon; hydrothecæ tubular, sessile or with a short pedicel, without an operculum, more or less regularly disposed on the stem and branches; polypites cylindrical, with a conical proboscis.*

Reproduction unknown.

THE section of Johnston's *Campanularia* including the smaller species with tubular and somewhat densely cor-

neous calyces, which are slightly, if at all, pedunculate, differs widely from the forms with which he associated it. To Lamouroux belongs the credit of having first recognized as distinct the type of structure which it exhibits. His *Lafoëa* was founded (in 1812) on an American species (*L. cornuta*) which closely resembles the well-known *L. dumosa*, and may be identical with it. The genus, however, was lost sight of until, in 1862, it was restored by Sars. In the meantime I had constituted the genus *Calicella* for the *Campanulariæ* with tubular calyces, including under it both the operculated and inoperculated forms. This name, of course, must give way to *Lafoëa*, so far as one section of the group is concerned; but as I have decided to form the species with an operculum into a separate genus, I retain it for them.

It is a remarkable fact that as yet no observations have been made that throw any light on the reproductive history of the present genus. This is the more extraordinary as the species are profusely developed, and *L. dumosa* is one of the commonest and most widely distributed of the Hydroida. Amongst some thousands of specimens, examined from time to time, I have never met with any trace of reproductive bodies. Sars records a similar experience*. Agassiz, indeed, has referred a medusiform zooid observed by his son to the *Lafoëa cornuta* of Lamouroux; but we learn from A. Agassiz, in his 'Catalogue of North American Acalephæ,' that this is a mistaken identification.

Of course, the present definition of the genus *Lafoëa* can only be regarded as provisional. It is quite possible that more than one type may exist amongst the species that are ranged under it.

* "Bemærkninger over fire norske Hydroida," Videnskab. Forhandlinger, 1862.

1. *L. DUMOSA*, Fleming.

SERTULARIA VOLUBILIS β , *Pallas*, *Elench.* 123.

„ *DUMOSA*, *Fleming*, *Edinb. Phil. Journ.* ii. 83.

TUBULARIA TUBIFERA, *Johnst.* *Edinb. Phil. Journ.* xiii. 222, pl. iii. figs. 2, 3.

? *LAFOËA CORNUTA*, *Lamx.* *Expos. Méth.* 5, pl. lxx. figs. 12, 14.

CAMPANULARIA DUMOSA, *Flem.* *Brit. An.* 548; *Johnst. B. Z.* 113, pl. xxvii. figs. 2, 5.

CORNULARIA DUMOSA, *Couch*, *Zooph. Cornw.* 39.

„ *RUGOSA*, *Gray*, *Ann. N. H.* i. 238.

CAPSULARIA DUMOSA, *Gray*, *Cat. B. M. Radiata*, 88.

CALICELLA DUMOSA, *Hincks*, *Cat. Dev. & Cornw. Zooph.* 23; *Ann. N. H.* (3rd ser.) viii. 293.

LAFOËA DUMOSA, *Sars*, *Videnskab. Forhandl.* 1862; *Allman*, *Ann. N. H.* for May 1864.

Plate XLI. fig. 1.

STEM simple and creeping, or erect and irregularly branched, both stem and branches being composed of several parallel tubes; **HYDROTHECÆ** *long, stout, narrowed towards the base, sessile*, with a plain aperture, springing from all sides of the stem and branches; **GONOTHECÆ** unknown; **POLYPITES** of a sulphur-yellow colour.

Var. *a. robusta* (Sars). More robust, thickly branched, with more numerous calyces, which are densely crowded together.

Var. β . With smaller calyces and a simple stem, which is attached at intervals only to other zoophytes, hanging from them in a festooned fashion. (*Alder.*)

Height of erect form from 2 to 4 inches.

L. DUMOSA is subject to many variations in habit, in the size of the calyces, in the thickness of the compound stem, the amount of branching, &c. In its humbler or dwarf condition it is met with in immense profusion, covering the stems of other zoophytes, running over the surface of seaweeds, or investing shells and stones with its delicate network and tiny tubes.

The erect form rises into bushy tufts. The calyces are of stout, *firm* material, and retain their shape when dried; they are sometimes distant, sometimes crowded together on the upright stem and branches.

The variety *robusta* (Woodeut, fig. 23) was at one time regarded by Sars as a species; but he subsequently changed his opinion, on finding a form intermediate between it and the normal *dumosa*.

The stems are composed of more numerous tubes than in the common form, and the calyces are somewhat shorter and thicker.

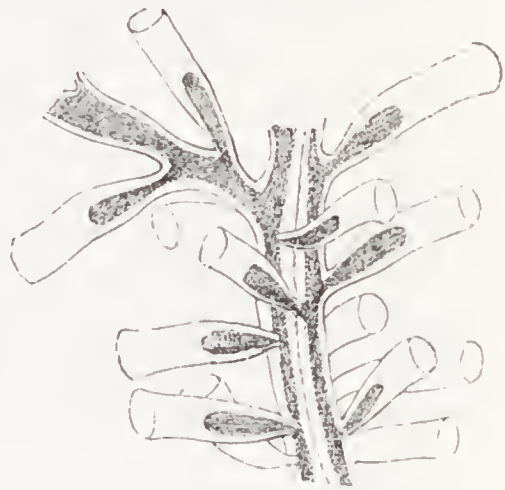
I have obtained this very striking variety, which was dredged by Sars near the North Cape in 30–50 fathoms, from the Coast of Cornwall. It has a very distinctive habit of growth.

The whole of the *cœnosare* in *L. dumosa*, as well as the polypite, is of a delicate sulphur-colour.

Hab. On various marine bodies from the littoral region to very deep water: very common and generally distributed. Dredged by Capt. Beechey, off the Mull of Galloway, in 145 fathoms, and the only hydroid found at this depth.

[Coasts of Norway (Christiania, Bergen, &c.) (Sars): (var. *robusta*) North Cape, 30–50 fath. (Sars): Labrador, Cateau Harbour, Long Island, not common (A. S. Paekard, jun.): Nova Scotia (*teste* A. Agassiz): Massachusetts Bay (A. Agassiz).]

Fig. 23.



2. *L. FRUTICOSA*, Sars.

CAMPANULARIA FRUTICOSA, Sars, Reise i Lofoten og Finnmarken, 18; Nyt Magaz. f. Naturvid. 1850, 6 B. 138.

„ *GRACILLIMA*, Alder, North. and Durh. Cat. in Trans. Tynes. F. C. iii. 129, pl. vi. figs. 5, 6.

CALICELLA FRUTICOSA, Hincks, Devon and Cornw. Cat., Ann. N. H. (ser. 3) viii. 293.

LAFOËA FRUTICOSA, Sars, Bemærkn. over fire norske Hydroid., Videnskab. Forhandl. 1862.

Plate XLI. fig. 2.

STEM erect, compound, irregularly and often subunilaterally branched; HYDROTHECÆ *very slender, long*, with an entire aperture, *of a thin and fragile material, borne on short pedicels, with 3 or 4 rings, or loosely twisted and with two whorls*; GONOTHECÆ unknown.

Height (when finely grown) about 3 inches.

As compared with *L. dumosa* this species is eminently delicate and fragile. It grows in shrubby tufts, and, when living, is of a light yellow or citron-colour. The calyces are distinctly stalked; they are much narrowed below, and a little above the base curve outwards on one side, and are slightly concave at the opposite point: this gives them a somewhat crooked appearance. The calyces of *L. dumosa* are much straighter and stouter; they are also of denser texture and sessile. The present species is made of much more delicate material than its sturdy ally, and, when dried, sorely disappoints the collector, the calyces shrivelling up and the specimen losing its beauty.

I have identified the *L. fruticosa* (Sars) and the *L. gracillima* (Alder), though not without some doubt. They differ chiefly in the character of the pedicel, which in the former is distinctly ringed, and from one-third to half the length of the calycle, while in the latter it is loosely twisted, “making about two turns” and not more than one-fourth the length of the calycle. The hydrothecæ also are

commonly longer and thinner in the British than in the northern form. Sars describes the polypite of his *fruticosa* as "white or ash-coloured;" but that of *gracillima*, as observed on beautiful specimens procured at Oban, where the species occurs in great luxuriance, is citron-coloured. If these differences should prove to be constant, it may be necessary to separate the northern from the British form, and to retain the two names. Authority is pretty well balanced on the point. Sars is inclined to regard them as distinct; Alder considered them identical.

Hab. On shells, zoophytes, &c. Northumberland and Durham (from deep water) occasionally (J. A.): Oban Bay (in 15–20 fathoms), very fine and abundant (T. H.): Shetland (A. M. N.): South Devon (J. A.).

[Common near Bergen in 30–50 fath., especially where there is a strong current; Tromsö, rarer; North Cape, extremely abundant (40–50 fathoms) in a strong current, on rocky ground (Sars): coast of Iceland, in 100 fathoms (the northern form) (T. H.).]

I have examined the *Lafoëa* from Bass's Straits in Mr. Busk's collection, referred to by Alder (North. & Durh. Cat.), and have little doubt that it is identical with the present species.

3. L. PARVULA, Hincks.

"Further notes on British Zoophytes," Ann. N. H. for March 1853, (ser. 2) xi. 178, pl. v. A.

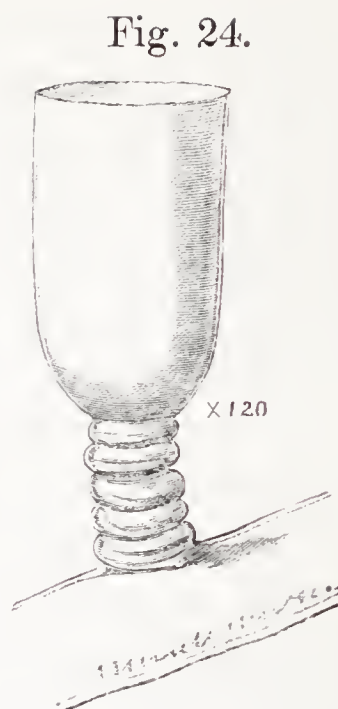
Plate XL. fig. 1.

STEM creeping; HYDROTHECÆ *very minute, cylindrical, broad (width considerably more than half the length), rounded off below, with an entire aperture, borne on short, ringed stalks (4 rings);* GONOTHECÆ unknown.

THE creeping stem is of great delicacy, and forms a rude

kind of network. The calyces are exceedingly minute, and of equal width throughout, till within a short distance of the base, when they are abruptly rounded off; they are of a somewhat dense corneous texture, and preserve their shape well when dried (Woodcut, fig. 24).

Hab. On *Nitophyllum* from the north of Ireland (Professor Hincks, University College, Toronto).



4. *L. POCILLUM*.

Plate XL. fig. 2.

STEM ereeping; HYDROTHECÆ minute, *tumid below, with the sides curved inwards above, and expanding again slightly towards the top*, aperture entire, borne on rather long, ringed pedicels; GONOTHECÆ unknown.

THE very graceful outline of the calyele distinguishes this species from all the other British members of its genus, amongst which the prevalent form is cylindric or simply tubular. It resembles a very elegant little goblet mounted on a twisted stem. In the hydrotheca of *L. pocillum* the lower half is the widest portion; above it the sides are incurved, but they expand again towards the aperture. The length of the pedicel varies; it usually consists of 6 or 7 rings, but is occasionally longer.

Hab. Oban Bay, ereeping over a seaweed (T. H.).

[Hamilton Inlet, Labrador (15 fathoms), on weed (*teste* T. H.).]

5. L. PYGMÆA, Alder, MS.

Plate XL. fig. 3.

STEM creeping; HYDROTHECÆ *very minute, cylindrical, elongate and narrow, of a yellowish horn-colour, borne on very short, ringed pedicels (2 or 3 rings)*; GONOTHECÆ unknown.

THIS form was discovered by the late Mr. Alder, and named by him in manuscript, but never published. It is extremely minute; the calycele is a narrow cylinder rounded off below and borne on a very short pedicel. In some of Mr. Alder's figures there are traces of a slight and shallow operculum; but I have not been able to distinguish one in the specimens which I have examined, and must leave it to other observers to decide the point. If it be an operculated species, it must be transferred to the following genus.

Hab. Tynemouth (J. A.): Gouliot Caves, Sark, in profusion (A. M. N.).

Genus CALYCELLA, *Hincks* (in part).

Der. A diminutive formed from κάλυξ, a cup.

CAMPANULARIA, Lamarck (in part).

GENERIC CHARACTER.—*Stem a creeping tubular fibre, or erect, compound, and branched, rooted by a filiform stolon; hydrothecæ tubular, with an operculum formed of convergent segments or a plaited membrane; polypites cylindrical, with a conical proboscis. Reproduction by means of fixed sporosacs, which (in the female) become extracapsular before the liberation of the ova.*

THIS genus, as originally constituted*, had a much wider

* "Cat. of South Devon and Cornw. Zooph.," Ann. N. H. (3rd ser.) viii. 293.

range, and included those Campanularian species of which the *C. dumosa* (Fleming) is the type. The restoration of Lamouroux's name (*Lafoëa*) for the latter group renders it necessary to define *Calycella* anew; and I now restrict it to the opereculated forms, of which *Campanularia syringa* (Linnæus) may be taken as the type.

1. *C. SYRINGA*, Linn.

"CREEPING BELL CORALLINE," *Ellis*, Corall. 25, pl. xiv. fig. b, B.

SERTULARIA SYRINGA, *Linn. Syst.* 1311.

„ VOLUBILIS, *Pall. Elench.* 122.

„ REPENS, *Ellis & Soland. Zooph.* 52.

CLYTIA SYRINGA, *Lamx. Cor. flex.* 203.

CAMPANULARIA SYRINGA, *Lamk. An. s. Vert.* (2nd ed.) ii. 132; *Van Beneden*, Camp. 37, pl. iii. fig. 9; *Johnst. B. Z.* 110, woodcut 19.

CAPSULARIA SYRINGA, *Gray, Cat. B. M. Radiata*, 86.

CALICELLA SYRINGA, *Hineks, Cat. Devon Zooph.* 23; *Ann. N. H.* (3rd ser.) viii. 294; *Allman, Ann. N. H.* for May 1864.

WRIGHTIA SYRINGA, *Agassiz, N. H. U. S.* iv. 354.

Plate XXXIX. fig. 2.

STEM ereeping, smooth; HYDROTHERÆ of a dark horn-colour, cylindrical, rounded off below, with a slightly sinuated margin, which is prolonged above into an operculum composed of 8 or 9 segments, borne on twisted pedicels of variable length, but with not less than three or four whorls; GONOTHECÆ oval, smooth, with short, ringed stalks (1 or 2 rings), distributed amongst the calyces.

THE rim of the hydrothecæ in this species is always described as perfectly plain; and so, on a first inspection, it appears to be. But a careful examination with the microscope shows that it is very slightly sinuated, rising at intervals into minute points, between which are extremely shallow depressions corresponding with the segments of

the operculum. The latter is often connected with a curious piece of structure.

It consists of a membranous tube or sheath, which rises to a greater or less height above the true margin of the calycle, and terminates in a serrated border. Within this sheath, and at the base of the denticulated edge, the operculum or lid is placed, composed of several converging segments, which fit closely together and constitute a conical roof to the little dwelling below. The crenated margin of the sheath, which is extremely delicate, rises above the top of it, and forms an ornamental border round it.

This structure is only met with on some of the calyces, and is so minute and delicate that it requires a high power and careful manipulation to master its details. It is a later growth, and is developed on the older hydrothecæ. The lid is sometimes drawn within the calycle and reversed, so as to exhibit the figure of an inverted cone.

The pedicel of *C. syringa* is of very various length, but when shortest has three or four rings (or spiral twists). The texture of the calyces is somewhat densely corneous, and they are generally of a deep horn-colour.

The acrocyt or external marsupium, in which the ova pass through the later stages of their development, is a spherical sac with a gelatinous covering, that rests like a ball on the summit of the capsule*.

The polypite has about sixteen arms.

Hab. On other zoophytes and on seaweeds; very common.

[Off Reikiavik, Iceland, in 100 fathoms (T. H.).]

* "Notes on the Reproduction of the Campanulariadae," by the Rev. T. Hincks, Ann. N. H. for August 1852.

2. *C. FASTIGIATA*, Alder.

CAMPANULARIA FASTIGIATA, Alder, Ann. N. H. for February 1860.

Plate XXXIX. fig. 3.

STEM ereeping, smooth, closely adherent; HYDROTHECÆ large, oblong, tubular, gradually tapering off below into a pedicel, which is smooth and of variable length,—above “rising into two opposite points, between which a plaited membrane on each side slopes over the aperture, forming an operculum with a medial ridge”*; GONOTHECÆ unknown.

Height of calycle $\frac{1}{10}$ inch.

ALDER has pointed out the resemblance of the remarkable operculum with which this species is furnished to the roof of a house, “the two opposite angles forming the gables.”

The pedicel is commonly about a third of the length of the calycle, but sometimes much longer. It exhibits no trace of annulation.

The *Lafoëa plicatilis* of Sars† (Woodcut, fig. 25) resembles this species in the structure of the operculum, but is otherwise distinct. It belongs to the present genus rather than to *Lafoëa*.



Fig. 25.

Hab. On the stem of a *Eudendrium* from the inner Hauf, Shetland (Barlee): the Hebrides (A. M. N.): on *Plumularia tubulifera* &c. from Cornwall (T. H.).

* Alder.

† “Bemærkninger over fire norske Hydroida,” Videnskabs. Forhandl. 1862. He describes the gonothecæ of *L. plicatilis*, which are very long and cylindrical, and contain many gonophores; but he has not observed the development of the sexual zooids.

Genus CUSPIDELLA, *Hincks*.

Der. Dimin. formed from *cuspis*, a point.

GENERIC CHARACTER.—*Stem creeping, filiform; hydrothecæ cylindrical or subcylindrical, perfectly sessile, with a conical operculum composed of many pieces; polypites cylindrical, with a conical proboscis.*

Reproduction unknown.

IN this genus there is no trace of a pedicel or erect stem; the calyces are not constricted towards the base, but are open cylinders to the point of junction with the creeping fibre.

When it was first constituted, only a single species was known; but I have since met with two more, in which the typical characters are well represented. All the species are exceedingly minute.

1. C. HUMILIS, *Hincks*.

CAMPANULARIA HUMILIS, *Hincks*, MS.; *Alder*, Suppl. North. & Durh. Cat. in Trans. Tynes. F. C. v. 239.

CALYCELLA? HUMILIS, *Allman*, Ann. N. H. for May 1864.

CUSPIDELLA HUMILIS, *Hincks*, Ann. N. H. for October 1866.

Plate XXXIX. fig. 4.

STEM very delicate; HYDROTHECÆ *subcylindrical, rather stout and short, the upper portion divided into 10 or 12 convergent segments, which form an operculum; GONOTHECÆ unknown.*

THE calyces of this curious and very minute species are like little cylinders rising directly from the creeping stem; occasionally they expand slightly upwards. The operculum is sometimes drawn within the calycle, as in the case of *Calycella syringa*.

Hab. On the stems of zoophytes. Llandudno, North Wales; Whitby; Shetland (T. H.): Northumberland, "on other zoophytes from deep water, occasionally" (J. A.).

2. *C. GRANDIS.*

Plate XL. fig. 4.

HYDROTHECÆ *cylindrical, slender, much elongated, sometimes curved, with an operculum composed of fewer and larger segments than in the last species*; GONOTHECÆ unknown.

Height of calyale about twice as great as in *C. humilis*.

THIS species differs from the preceding chiefly in the proportions of the hydrothecæ, which are narrow and comparatively gigantic; those of *C. humilis* are dwarfish, and broad in proportion to their height. In the present species the width is only about $\frac{1}{5}$ or $\frac{1}{6}$ of the height; in the last it is about $\frac{1}{2}$ or $\frac{1}{3}$ of it. There are also differences between the two forms in the operculum.

Hab. Birterbuy Bay, Connemara (G. S. Brady): Shetland (J. A.).

3. *C. COSTATA.*

Plate XL. fig. 5.

HYDROTHECÆ somewhat broadly cylindrical, *encircled by two or three rather prominent ribs, or lines of growth, dividing them into segments*, the uppermost or opercular segment formed of thinner material than the rest, and supporting a conical operculum, composed of very numerous convergent pieces; GONOTHECÆ unknown.

THE calyale of *C. costata* is generally divided into three segments, besides the uppermost. The latter is a delicate

and half-membranous continuation of the walls of the hydrotheca, and is crowned by a very beautiful operculum, which is capable, as in several allied forms, of being retracted within the cylinder. The transverse rings or ribs mark the periods of growth. The present species is very minute.

Hab. On *Syncoryne eximia*, Whitby, Yorkshire (T. H.).

Genus SALACIA, *Lamouroux**.

GRAMMARIA, Stimpson, Marine Invertebrata of Grand Manan, 9.

GENERIC CHARACTER.—*Stem erect, composed of aggregated tubes, branching, rooted by a filiform stolon (?); hydrothecæ cylindrical, sessile, without operculum, adnate for the greater part of their length, disposed on all sides of the stem and branches in regular and equidistant longitudinal series; gonothecæ scattered on the stem and branches; gonophores unknown.*

Polypites long, cylindrical, with a conical proboscis.

THE *Salacia* of Lamouroux, founded on an Australian Hydroid (*S. tetracyttara*), is identical in all essential particulars with the *Grammaria* of Stimpson, and I have therefore restored his name. In Lamouroux's species the stem is much compressed, and the apertures of the hydrothecæ are on a level and scarcely project, but in other respects it closely resembles the American and British form.

Salacia is very nearly related to *Lafoëa*. The principal difference between them is to be found in the disposition of the calyces: in the latter genus they are irregularly distributed; while in the former they are arranged on a

* Polypes Flex. Corallig. p. 214; Exposition Méthodique, p. 15.

definite plan, and form regular, longitudinal rows. In *Lafoëa* they are free throughout their entire length, and patent; in *Salacia* they are in great part adnate.

Sars has pointed out that in the present genus the hydrothecæ are not separated from the stem by any constriction, and that the polypites when contracted can withdraw themselves wholly from them into the tube of the stem.

S. ABIETINA, Sars.

CAMPANULARIA ABIETINA, Sars, Reise i Lofoten og Finm., Nyt Magaz. f. Naturvid. 1850, 139.

GRAMMARIA ROBUSTA (young), Stimpson, Marine Invert. of Grand Manan, 9, tab. i. fig. 3.

„ RAMOSA, Alder, Cat. of North. and Durh. Zooph. in Trans. Tynes. F. C. iii. 130, pl. iv. figs. 1-4; v. 239, 240.

„ ABIETINA, Sars, Bemærkn. over fire Norske Hydroider, Videnskabs. Forhandl. 1862.

Plate XLI. fig. 3.

STEM stout, horn-coloured, irregularly branched, the branches constricted at the base; HYDROTHERCÆ disposed in four (or five) longitudinal rows, those of the adjacent rows alternating, those of the opposite on a line with each other, free above, and bending outwards to a distance nearly equalling the width of the stem, with an even margin; GONOTHECÆ unknown; POLYPITES of a sulphur-colour, with 18-20 tentacles.

Height, in fine specimens, nearly 4 inches.

THIS species has been fully investigated by Sars, who has obtained it abundantly on the Norwegian coasts, and has had ample opportunity of studying it in a living state. He has given a detailed account of the polypites, which are of the same type as those of *Lafoëa dumosa*. "They are cylindrical, very slender and tall, so that when extended they only occupy a third of the diameter of the

ealycle, and project fully a calycle's length beyond the opening. The body is slightly thicker at the upper extremity, where the mouth is placed on the top of a conical proboscis, which rises from the centre of the tentacular wreath." The tentacles are held alternately erect and standing out straight from the body. The colour of the polypites is light sulphur or greenish yellow. "They are very shy, seldom protrude themselves, and only when they are in perfectly fresh sea-water. At the slightest touch or shaking of the vessel in which they are kept, they draw themselves back with extreme rapidity and with a jerk, like the Polyzoa, not only into their ealyeles, but, as the latter are not furnished with a transverse partition, even out of them, and within the tube of the compound stems and branches, so that the ealyele is left quite empty." "The whole polypary is strong, rigid, of a light brownish-yellow colour; the ealyeles are transparent, with a slight yellowish tinge"*. Sars has never found any trace of the reproductive bodies.

The *Grammaria robusta* (Stimpson) is founded on young and unbranched specimens of the present species.

Hab. From the deep-water fishing-boats, Northumberland, rather rare; Coquet and Berwick Bay (J. A.): Shetland, not rare in deep water (A. M. N.).

[Near Bergen, in 30-40 fathoms, on stony ground, not rare; North Cape, of larger size and more luxuriantly branched (Sars): Grand Manan, Bay of Fundy, Laminarian zone (Stimpson).

Salacia abietina is confined to the north, and, according to Sars, is a truly Arctic form. The north appears to be the headquarters of the *Lafoëidae* generally.]

* Bemærkninger over fire Norske Hydroider, p. 13.

Genus FILELLUM, *Hincks*.Der. Dimin. of *filum*, a thread.

RETICULARIA, Wyville Thomson.

GENERIC CHARACTER.—*Stem creeping, filiform, reticulate, immersed in a chitinous crust; hydrothecæ tubular, decumbent, adherent, without operculum, irregularly disposed along the stem, to which they are attached at the base or by a short stalk; gonothecæ unknown.*

THIS genus was constituted by Prof. Wyville Thomson under the name of *Reticularia*, which unfortunately had been previously assigned to a group of Fungi, and therefore cannot be retained.

I have not been able to satisfy myself as to the presence of a crust involving the creeping stem, and have included this character in the definition of the genus on the authority of Prof. Thomson.

F. SERPENS, Hassall.

CAMPANULARIA SERPENS, *Hassall*, Zoologist, No. 69, 2223; Transact. Micr. Soc. iii. (1852) 163, pl. xxi. fig. 4.

CAPSULARIA SERPENS, *Gray*, Brit. Mus. Radiata, 151.

RETICULARIA IMMERSA, *Wyville Thomson*, Ann. N. H. (2nd ser.) xi. 443, pl. xvi. figs. 2, 3.

„ SERPENS, *Hincks*, Ann. N. H. (2nd ser.) xviii. 469 (1856).

Plate XLI. fig. 4.

STEM extremely delicate, forming an irregular network; HYDROTHECÆ oblong, with an even patulous rim, attached for about two-thirds of their length, free and curved upwards towards the aperture, sessile or with a very short stalk, sometimes laid alongside the stem, and sometimes forming an angle with it; GONOTHECÆ unknown; POLYPITES very minute, of a greenish colour.

THIS is the common parasite of some of the larger Sertu-

lariidæ, and especially of *Sertularia abietina*. The calyces very generally overspread the stem of this zoophyte, and are often so densely and confusedly massed together that it is difficult to distinguish their shape; in such specimens they form a crust, bristling with the free tubular orifices. On a broader surface, where there is space for more regular development, the species assumes a very different and a much simpler appearance; the hydrothecæ are sparingly distributed, and their character is recognized at once. Specimens of this kind are found occasionally on shells. The calyces sometimes occur in pairs, one on each side of the stem, sometimes singly, and sometimes in companies.

Hab. On *Sertularia abietina*, *Hydrallmania falcata*, and other zoophytes, and on shells occasionally; very common.

[Off Reikiavik, Iceland, in 100 fathoms (T. II.).]

Family V.—Trichydridæ.

HYDROTHERCÆ *merely rudimentary, tubular*; POLYPITES *cylindrical, very extensile, with a small conical proboscis*.

Genus TRICHYDRA, T. S. Wright.

Der. From *τρίχ* (*trichòs*), hair, and *Hydra*, a polypite.

GENERIC CHARACTER.—*Stem creeping, branched; hydrothecæ rudimentary, consisting of very short tubular processes, given off at intervals from the creeping stem; polypites cylindrical, very slender and extensile, with a short conical proboscis.*

Reproduction unknown.

I FEEL very doubtful as to the true position of this obscure genus. Wright would place it amongst the *Corynidæ* of Johnston, on account of the progressive development of

the tentacles. He also states that the polypites show no disposition to hold the tentacles in a double row; but Van Beneden's testimony is to the opposite effect*. He ranks the species under *Eudendrium*, with which genus, as now defined, it has little in common.

Allman includes *Trichydra* amongst the *Campanulariidæ*; but it has no affinity with the typical forms of this family. Any position assigned to it at present can only be regarded as provisional.

The polypites in many points resemble those of the *Lafoëidæ* and *Campanulinidæ*, and are wholly retractile within the tubular *thece*. The latter, though remarkable for their minuteness, exhibit the simple cylindrical form which is met with in some of the *Lafoëidæ*. In the absence of all trustworthy information† respecting the gonosome, I shall make *Trichydra* the type of an allied family.

T. PUDICA, T. S. Wright.

TRICHYDRA PUDICA, *Wright*, Edinb. New Phil. Journ. (N. S.) for Jan. 1858, 6, pl. iii. fig. 1.

? EUDENDRIUM PUDICUM, *Van Beneden*, Faune Litt. de Belg. Polypes, 116, pl. viii. figs. 1, 2.

Woodcut, fig. 26.

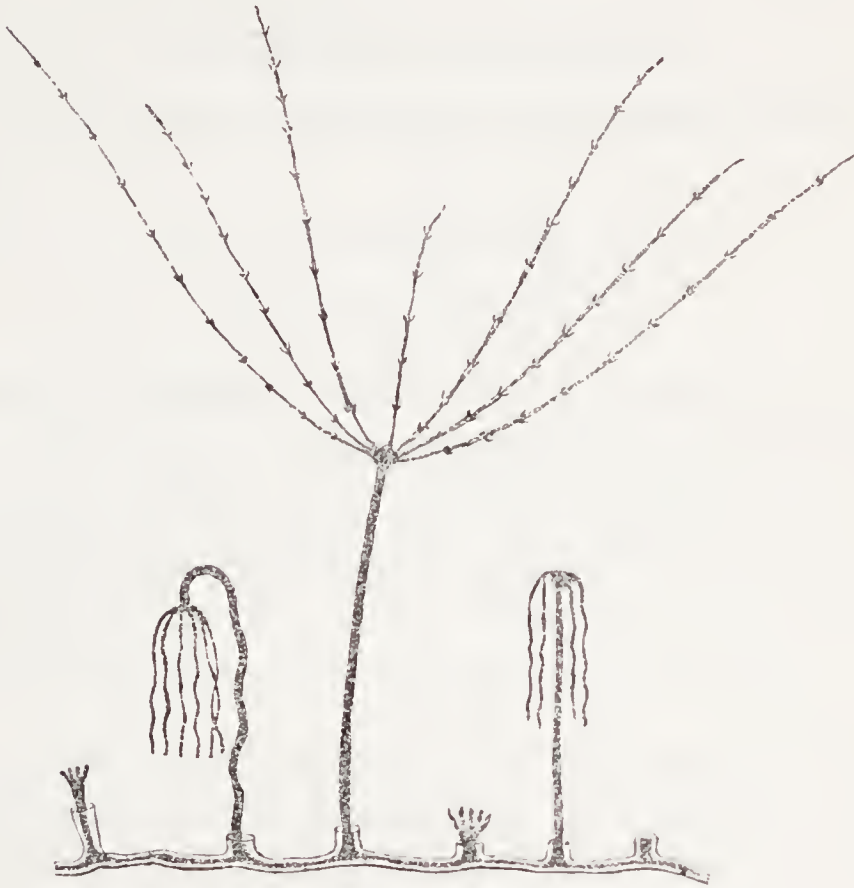
CÆNOSARC enclosed in a transparent, membranous polypary; HYDROTHERCÆ cylindrical, even-rimmed, of un-

* It may perhaps be doubtful whether Van Beneden's zoophyte is identical with the present form, since he represents the polypary as a delicate and transparent covering, which extends over a great part of the body of the polypite, rising much higher than in Wright's figures. In other points it agrees with it.

† Wright figures a medusoid (Micr. Journ. iii. 50, pl. vi.) which he found in the vessel containing *Trichydra*, and fancied might be its sexual zooid; but he could detect no trace of gonophores on the zoophyte, and we must therefore wait for further evidence.

equal length, but all very short; POLYPITES about $\frac{1}{8}$ inch in length, exceedingly attenuated during extension,

Fig. 26.



transparent, with the exception of the proboscis, which is of a dense silvery white; TENTACLES 4-12, long and waving.

“THIS interesting little zoophyte is remarkable for the laxity of its habit and the extensibility and transparency of its polyps.” When at rest they “extend their bodies and tentacles to their utmost length; but a sudden glare of light or shaking of the vessel in which they are confined causes the modest hair-polyp to contract itself, or to bend the buccal cavity and tentacles loosely downwards, like a flower drooping on its stalk. It seldom entirely withdraws itself into its cell unless irritated.” (*Wright.*)

Hab. The “Fluke Hole,” Firth of Forth, covering a

small shell; "shells and stones, which have been kept quiet in an aquarium for some time, are occasionally covered with it" (T. S. W.).

Family VI.—Coppiniidæ.

HYDROTHECÆ *united by an encrusting, cellular mass.*

Genus COPPINIA, *Hassall.*

Der. Named after Mr. Coppin.

GENERIC CHARACTER.—*Zoophyte consisting of a number of long tubular hydrothecæ crowded closely together and united by an adherent cellular mass, which involves the lower portion of them, the upper portion remaining free; ova developed in the cavities of the cellular mass, and escaping as planulæ; polypites cylindrical and very extensile.*

THIS is an aberrant form amongst the Hydroida; and too little is known of its structure and development to enable us to speak with confidence respecting its relations to its tribe. Its ealyele and polypite ally it to the *Lafoëidæ*, and it is propagated, like the Hydroida generally, by means of planulæ; but it presents us with several striking peculiarities. The individual polypites are not united at the base by a creeping stem, but are bound together by a spongy, cellular mass, in which their ealycles are plunged, as it were, for a considerable portion of their length. This mass adheres to the surface, and often involves the stem, of various Sertularian zoophytes.

"Additions to the colony," according to Prof. W. Thomson, "appear to take place by the budding of the hydræ at the base of the tube-like cell, by which process a new hydra is formed, which is separated from its parent, secretes a tube-cell of its own, and ultimately secretes a

quantity of granular matter, which pushes it still further from the rest of the community.”

The ova are produced in the cavities or compartments which pervade the common connecting-substance, and give a tessellated appearance to its upper surface; they are found in great numbers clustering around the tubes of the hydrothecæ, in the upper portion of the matrix, a little below the surface. I have never seen them in the deeper parts of it. After the escape of the planules, a small aperture is visible in the covering of each compartment. Dalyell, from whom we have the fullest account of this zoophyte, throws no light on the nature of the ovarian chamber or the development of the ovum; and in the few cases in which I have had the opportunity of examining recent specimens, I was unable to determine these points.

The ova lie singly or in clusters, and without any regularity of arrangement, within the matrix. Each of them is enclosed in a delicate, transparent membrane.

The planule is elongate, broad at one end, and tapering off towards the other, about one-third of a line in length, and not ciliated. It moves in worm-fashion, and is of a greenish-yellow colour. When it ceases to move, according to Dalyell, the body becomes round and deeply annulated, exhibiting a number of prominent segments. One end enlarges while the other is elongating, and the latter is moulded into a calycle with its contained polypite.

C. ARCTA, Dalyell.

SERTULARIA ARCTA, *Dalyell*, Rare and Remark. An. Scotl. i. 224, pl. xlii.

COPPINIA MIRABILIS, *Hassall*, Zoologist, No. 69, 2223; Trans. Microscop. Soc. iii. 160, pl. xxi. figs. 1, 2.

Plate XLI. fig. 5.

ZOOPHYTE forming small, irregular, encrusting masses of

a greenish-yellow colour; HYDROTHECÆ long and slender, with an even aperture, the free portion generally curved; POLYPITES with 8–10 tentacles, stretching to a great distance beyond the opening of the calycle when extended.

THE calycle is provided with a valve-like operculum, which closes on the retreat of the polypite. Great numbers of planulæ are liberated; and as they escape the mass loses its yellowish colour, which is due to their presence.

It is not improbable that the *Campanularia intertexta* of Couch (*Conchella intertexta*, Gray) may have been founded on the present species; but the description in the ‘Cornish Fauna’ is not sufficient for identification.

Hab. On the stems of other zoophytes, especially *Sertularia abietina* and *Hydrallmania falcata*; common and widely distributed.

Family VII.—Haleciidæ.

HYDROTHECÆ *biserial, sessile, jointed to a lateral process from the stem*; POLYPITES *partially retractile*.

Genus HALECIUM, Oken *.

THOA, Lamouroux (1816).

GENERIC CHARACTER.—*Zoophyte plant-like, more or less branched, rooted by a creeping stolon; hydrothecæ biserial, tubular or deeply campanulate, sessile, jointed to a short lateral process from the stem; polypites partially retractile, large and fusiform; gonothecæ scattered, dissimilar in the two sexes; reproduction by means of fixed sporosacs.*

THE genus *Halecium* is somewhat intermediate between

* Lehrbuch Naturg. 91 (1815).

the Campanularian group and the *Sertulariidae*; its calyces are subsessile, and not let into the stem as in the latter family. Its habit makes an approach to that of the *Campanulariidae*; while its large and scarcely retractile polypites remind us of those of the Athecata.

In some species, and possibly in all, the female capsule exhibits a curious peculiarity, being surmounted at a certain stage by two perfectly formed polypites which protrude from the orifice, and are seen to be a continuation of the column that traverses the cavity and bears the gonophore. This is the only instance amongst the Thecaphora in which the proliferous polypite is not permanently atrophied and reduced to a mere columnar offshoot from the cœnosarc; but amongst the Athecata it is commonly fully developed, and the cases of partial or complete atrophy are exceptional. These capsular polypites were first noticed by Van Bencden on *H. halecinum*; they occur on *H. Beanii*; and I have also found them on *H. nanum*, a species from the gulf-weed described by Alder.

The marked peculiarities of *Halecium* entitle it to be made the type of a distinct family.

1. *H. HALECINUM*, Linnæus.

"HERRING-BONE CORAL," *Ellis*, Corall. 17, pl. x.

SERTULARIA HALECINA, *Linn.* Syst. 1308; *Pall.* Elench. 113; *Esper*, Pflanz.

Sert. t. xxi. figs. 1, 2; *Lamk.* An. s. V. (2nd ed.) ii. 146.

THOA HALECINA, *Lamx.* Cor. flex. 211; *Blainv.* Actinolog. 488, pl. lxxxiv.
figs. 4, 4 a.

HALECIUM HALECINUM, *Schweigger*, Handb. 426; *Johnston*, B. Z. 58, pl. viii.

Plate XLII.

SHOOTS erect, of a rigid habit, irregularly branched, springing from a sponge-like mass of fibres; STEMS compound, made up of many delicate tubes, tapering upwards;

principal branches also compound, pinnate, or bipinnate; pinnæ alternate, placed at regular intervals, sometimes themselves pinnate, jointed, the internodes short and stout; HYDROTHECÆ alternate, one or a pair immediately below each joint, *tubular, with a plain and slightly everted rim*; GONOTHECÆ borne in rows on the upper side of the pinnæ,—(male) ovate, slender, tapering off below, with a very short pedicel of about two rings; (female) *oblong, broad above and narrowing towards the base, with a short tubular orifice at one side of the subtruncate top*.

THIS species, which is one of the commonest of the British Hydroids, attains a height of from 6 to 10 inches; it is somewhat coarse in appearance, and characterized by a marked angularity and stiffness of habit. The disposition of the branches and pinnæ is very regular and definite, and they all form an acute angle with the stem from which they spring. The calyces, in their simplest condition, consist of a single tubular piece articulated to a projection from the stem; in older specimens, however, they are made up of several such pieces, which fit into one another and mark the successive generations of polypites.

The principal stems are composed of a multitude of extremely delicate tubules, agglutinated together, as many as a hundred strands combining in the main trunk of the zoophyte. Some of these diverge at regular intervals to form the larger branches and the pinnæ, and the stem is thus gradually attenuated upwards, until at the apex it runs out to a fine point. The polypites are large, elongate, somewhat fusiform, and have rather thick tentacles.

Hab. On shells, stones, &c., in both shallow and deep water, but more usually the latter; very common and generally distributed.

[Coast of Belgium (Van Ben.): Greenland (Mörch): Tromsö and North Cape in 30–50 fathoms, common (Sars): Labrador (A. S. Packard, jun.): Massachusetts Bay (A. Agassiz): Mediterranean (*teste* Pallas).]

2. H. MURICATUM, Ellis and Solander.

SERTULARIA MURICATA, *Ellis & Soland.* Zooph. 59, pl. vii. figs. 3, 4; *Esper*, Pflanz. Sert. tab. xxxi. figs. 1, 2.

LAOMEDEA MURICATA, *Lamx.* Expos. Méth. 14, pl. vii. figs. 3, 4.

CAMPANULARIA MURICATA, *Blainv.* Actinolog. 473.

THOA MURICATA, *Couch*, Corn. Faun, pt. iii. fig. 16.

HALECIUM MURICATUM, *Johnst.* B. Z. 60, pl. ix. figs. 3, 4.

Plate XLIII. fig. 1.

ZOOPHYTE *stout and rigid*, springing from a fibrous mass, *irregularly and densely branched, yellowish brown*; STEM and branches compound, consisting of many tortuous tubes agglutinated together, sometimes simple at the extremity; branches erecto-patent, pinnate, slightly tapering; pinnæ alternate, delicate, jointed; HYDROTHECÆ placed alternately, one below each joint, *tubular, rather short, with a much everted rim*; GONOTHECÆ *ovate, on a short pedicel, roughened by raised rows of prickles, which radiate towards each side from a central line, crowded on the stem and branches.*

H. MURICATUM is of a rugged aspect; the stems and branches are thick and coarse, and frequently almost hidden by the clustering masses of capsules. The ramification is luxuriant, erect, and rigid.

The capsules, which are beautiful objects under the microscope, have much the appearance of a minute bivalve shell, with a spinous surface; they are borne in extraordinary profusion on all parts of the zoophyte. No

difference between the sexes in the shape of the gonotheca has as yet been noticed.

Hab. On shells, &c., from deep water, not common; Peterhead, Wick, Banffshire, from fishermen's lines; Firth of Forth (C. W. P.): on oyster-shells from Loch Ryan (D. L.): Northumberland (J. A.): Seaton (J. Hogg): Whitby (T. H.): Scarborough (W. Bean): Cornwall, off Mevagissey, rare (Couch): Giant's Causeway (A. H. H.).

[Off Reikiavik, Iceland, in 100 fathoms (T. H.): on a fishing-bank off Caribou Island, Straits of Belle Isle, in 30–50 fath., frequent; Square Island, a few miles north of Cape St. Michael, in 30 fath., common (A. S. Packard, jun.).]

3. *H. BEANII*, Johnston.

THOA BEANII, Johnston, B. Z. (1st ed.) 120, pl. vii. figs. 1, 2.

HALECIUM BEANII, Johnston, B. Z. (2nd ed.) 59, pl. ix. figs. 1, 2.

Plate XLIII. fig. 2.

ZOOPHYTE *shrubby*, irregularly branched, *of a delicate and graceful habit*; *STEM* and larger branches compound, tapering upwards, pinnate; pinnæ alternate, often branched, slightly zigzag, jointed at short intervals; *HYDROTHECÆ* alternate, one below each joint, *small, tubular, somewhat dilated towards the aperture*; *GONOTHECÆ* borne at the base of the calyces,—(male) elongate-ovoidal; (female) *slipper-shaped*, with a short tubular orifice in the middle of the upperside.

THIS pretty species is extremely light and delicate, and, in the absence of the curious female capsule, may be easily recognized by its habit and mode of growth. In its young state it is simply pinnate, but becomes much and variously branched and assumes a very bushy appearance. The

stems are much more slender than those of *H. halecinum*, the ramification is more irregular and intricate, and there is none of the stiffness and formality which characterize that species.

H. Beanii seems to be generally diœcious; but the two sexes are sometimes mingled on the same shoot. The female capsule contains from 4 to 6 ova, arranged in a row, which are matured into white, somewhat flask-shaped planulæ. This species is commonly about two inches in height, but occasionally rises to five or six.

Hab. On shells &c., and very often parasitic on other zoophytes, from moderate depths to deep water; common and widely distributed.

4. *H. LABROSUM*, Alder.

Ann. N. H. (ser. 3) iii. 354, pl. xii. figs. 1-3.

Plate XLIV. fig. 1.

ZOOPHYTE irregularly branched, and of a somewhat flaccid habit, purplish when fresh, attached by numerous fibres; STEM composed of several tubes; the larger branches also compound, generally dividing dichotomously, pinnate; *pinnæ* alternate, jointed, often bearing pinnules, and more or less ringed transversely above each joint; HYDROTHECÆ borne singly or in pairs below the joints, moderately deep, much expanded and everted at the margin, jointed and ringed at the base; GONOTHECÆ (male) ovate, broad below and obtusely pointed above, of a purplish-brown colour, set on a short pedicel of about two rings; (female) ovate, broad below and tapering upwards, cleft at the summit.

THIS fine species is one of Mr. Alder's numerous additions to the list of British zoophytes. It may be readily distinguished from *H. halecinum*, even if the reproductive

capsules should be absent. Its mode of growth is lax and irregular, and contrasts strongly with the stiff and erect habit of its ally; its stems are not so stout, and the texture is more delicate. The annulation of the branches which is often very strongly marked, and the form of the deep, somewhat campanulate calycle, with its elegantly everted margin, are good distinctive signs. The purplish colour, too, seems to be a constant character in fresh specimens.

The male capsules only have been described by Mr. Alder. I am indebted to Mr. Peach for very fine specimens from Wick, bearing the females in abundance. (Woodcut, fig. 27.)

As in the other species of this genus, the calycles are often composite, several cups rising one within the other and registering, as it were, the number of polypites that have budded successively and perished.

H. labrosum is commonly between 3 and 4 inches high, but occasionally reaches 6 inches.

Hab. Coast of Northumberland, deep water (Alder): Moray Firth (Mr. Macdonald): Shetland (Barlee): Wick, on fishermen's lines (C. W. P.).

Fig. 27.



5. *H. TENELLUM*, Hincks.

HALECIUM TENELLUM, *Hincks*, Cat. Devon & Cornw. Zooph., Ann. N. H. (3rd ser.) viii. 252, pl. vi. figs. 1-4.

HALECIUM LABROSUM (young), *Alder*, Ann. N. H. (3rd ser.) iii. 355.

Plate XLV. fig. 1.

ZOOPHYTE minute and extremely delicate; *STEM* slender,

often strongly ringed at intervals, irregularly branched, *branches given off at the base of the calyces, sometimes singly, sometimes in pairs*; HYDROTHECÆ *funnel-shaped, gracefully everted at the margin*, often of considerable length, *in many cases a number (frequently 4 or 5) rising one within another*; GONOTHECÆ ovate, smooth, borne on short pedicels and occurring singly.

Height of fine specimens from $\frac{1}{4}$ to $\frac{1}{2}$ an inch.

THIS very beautiful species is remarkable for its extreme slightness and delicacy. There is much variety in the amount of annulation on the stems and branches; sometimes, as in the specimens from which my first description was taken, they are almost smooth, in other cases they are distinctly and very elegantly ringed. A simple calycele is rarely met with on mature specimens. Generally the polypite protrudes from the uppermost of a pile of little eups, with prettily everted rims, which fit one into the other.

The capsules vary in form, being broadly ovate, or slender and somewhat pointed above; they contain a single, large gonophore.

Hab. On zoophytes and Polyzoa. Salcombe Bay, Devon, on *Salicornaria farciminoides*; Filey (T. H.): Northumberland, on *Tubularia indivisa* and *Sertularia abietina*, from deep water (J. A.).

6. H. PLUMOSUM.

Plate LXIV. fig. 1.

SHOOTS *tall and slender, flexible, sparingly branched*; STEM *and branches compound, tapering, pinnate*; *pinnae* alternate, placed at regular intervals, *simple, delicate*, sometimes bearing a few pinnules, *divided by oblique joints into very short and somewhat wedge-shaped internodes*;

HYDROTHECÆ alternate, one immediately below each joint, *the lateral process small and closely appressed to the stem, the cup slender, expanding at the top, and slightly everted*; GONOTHECÆ unknown.

I VENTURE to describe this species, from a specimen in the collection of Trinity College, Dublin, even in the absence of the reproductive capsules. The most marked characteristic is the slender, flexible, and feathery habit. The stem, though composed of several tubes, is delicate as compared with that of *H. halecinum*, and altogether wanting in the rigidity which belongs to that species. The minute structure of the pinnæ is also peculiar; they are divided, by joints which are decidedly oblique (slanting alternately in opposite directions), into numerous very short segments, which are not of equal width throughout, but taper somewhat downwards. The process that supports the hydrotheca projects but little; and the cup is small, with a slightly everted margin. *H. plumosum* attains a height of 6 inches.

The *H. filiforme** of Alder seems to resemble the present species in its mode of growth, but it is described as having a simple stem and rather long internodes.

Hab. Ireland.

* I do not include this form in the present work, as Mr. Alder, I believe, saw reason to change his opinion about it, and to regard it as probably a mere variety or an immature state of some other species. The following is his description:—

“*H. FILIFORME*, n. sp.—*Polypary* very slender, flexible, simple or consisting of a single tube throughout; the stem not much branched; branchlets short, alternate, arising from the side of a cell; the internodes rather long; cells rather slender, tubular, with a slightly everted margin. Length $4\frac{1}{2}$ inches.”—*Suppl. Cat. North. & Durh. Zooph.*

7. H. GENICULATUM, Norman.

"On the Hydrozoa &c. of the Hebrides," Report of the British Assoc. for 1866, 196.

STEM *slender, branching*, the branches all in the same plane; *branchlets flexuous, bending alternately right and left between the calyces*, jointed, the joints consisting of a single stricture or more rarely two; HYDROTHECÆ borne immediately below the joints, *much elongated, simply tubular, fully two-thirds as long as the internodes*, constricted near the base; GONOTHECÆ unknown.

Height $1\frac{1}{2}$ inch.

THE bent stem, resembling in this respect that of *Obelia geniculata*, and the very long calyces are the most salient characters.

Hab. Dredged in deep water in the Minch (A. M. N.).

8. H. SESSILE, Norman.

"On the Hydrozoa &c. of the Hebrides," Report of the Brit. Assoc. for 1866, 196.

Plate XLIV. fig. 2.

STEM slender, irregularly branching, branches not in the same plane; branchlets jointed, the joints consisting of a single stricture; HYDROTHECÆ alternate, *very short, and perfectly sessile, not rising at all separately from the lateral stem-processes, of which they are mere openings, without being raised into a tube*; GONOTHECÆ unknown; POLYPITES *large*, very narrow at the base, thence gradually expanding to the summit, where they suddenly swell into a wide, campanulate mouth; tentacles long and slender.

Height (probably) $1\frac{1}{2}$ inch.

THE size of the polypites in this species is remarkable.

They rise, according to Norman, "above the hydrotheca to a height (exclusive of tentacles) which is not less than five times its diameter, and far overtop the level of the succeeding hydrotheca." The calyces are quite rudimentary.

Hab. In deep water in the Minch (A. M. N.).

Genus OPHIODES, *Hincks*.

Der. ὀφιδῶδης, snake-bearer.

GENERIC CHARACTER.—*Stem branching, rooted by a creeping stolon; hydrothecæ vase-shaped; polypites not retractile within the calycle; the body deeply constricted a little below the base of the tentacles; tentacles in a single verticil, muricate, webbed, and surrounding a conical proboscis; tentaculoid organs borne singly on the stem and on the creeping stolon, highly extensile, protected at the base by a small chitinous cup, and terminated at the upper extremity by an enlarged capitulum armed with thread-cells; reproduction by means of fixed sporosacs.*

THE remarkable tentacular organ with which *Ophiodes* is furnished, and which may be regarded as the equivalent of the nematophore, consists of a very extensile, snake-like appendage, with an enlarged head, attached at the lower extremity by an extension of the cœnosarc. The base is protected by a small chitinous tube, which expands from its point of origin upwards; the capitulum contains numerous thread-cells, from which very long threads, barbed below, are emitted.

These tentaculoid organs are capable of great elongation and contraction, and execute the most vigorous movements, stretching themselves out with apparent eagerness

and twisting in all directions. When extended, they are often three or four times the length of the polypite, and in this state appear as most delicate, hair-like filaments. My attention was first drawn to the zoophyte by a number of them dispersed on the creeping stolon, which were twirling themselves about in the maddest fashion, as if to seare away invaders.

One of these curious organs is almost always attached to the stem a little below the calyale, and when extended rises far above it; and as it twists itself about, with its formidable armature ready for instant action, it has all the appearance of a purveyor or protector to the polypite.

A striking feature of the genus *Ophiodes* is the constriction of the body of the polypite, dividing it into two well-marked regions—the *oral*, including the proboscis and the tentacular wreath and a kind of *quasi*-pharynx, and the *aboral*, traversed by the digestive cavity.

The polypite does not extend to the bottom of its hydrotheca, but rests on a membranous diaphragm that shuts off the upper third of it and forms a cup-shaped chamber. This diaphragm is perforated in the centre (Plate XLV. fig. 2 c); and through the orifice the body is linked on to the cœnosarc, which traverses the lower portion of the calyale.

O. MIRABILIS, Hineks.

Annals N. H. for November 1866, (ser. 3) xviii. 421, pl. xiv.

Plate XLV. fig. 2.

STEM erect, sparingly branched, rudely annulated at the base, and jointed at intervals throughout; HYDROTHERCÆ bulging slightly immediately above the base, with the

sides incurved, expanding gradually towards the top, with a patulous opening and an everted rim; a single TENTACULOID ORGAN on the stem a little below the calycul, and many distributed on the creeping stolon; GONOTHECÆ ovate, ringed transversely, with a wide tubular neck, subpedicellate, borne on the creeping stolon; POLYPITES very tall when extended, the inferior portion of the body clavate, the oral funnel-shaped; tentacles about 18, a brownish cluster of thread-cells between each pair, on the connecting web.

Height about $\frac{1}{8}$ inch.

THE branching of *O. mirabilis* is very slight and simple. It forms small tufts, bearing three or four polypites; the extremity of the stem often runs out into a long, filamentary offshoot, with short lateral branches.

The polypite, when fully extended, is a singularly beautiful object, imitating to some extent the form of a tall and graceful candelabrum; only the base of the body is within the calycul. The web that unites the lower portion of the tentacles forms a rather deep cup* surrounding the proboscis, with the batteries of thread-cells, which glitter against a dark ground, set round the outside of it. These intertentacular thread-cells are similar to those which thickly cover the capitulum of the snake-like organs. They emit a very long thread with a barbed base; these slender filaments may be seen east forth beyond the tentacles and intermingling with them, and must constitute an effective auxiliary force for the capture of prey. The arms are held alternately elevated and depressed.

When kept in confinement the tentacles are soon thrown back, drooping listlessly downwards, and the pro-

* There is a conspicuous opaque-white collar within this cup, at the base of the arms.

boscis becomes extraordinarily prominent; the whole aspect of the polypite is changed.

I have only met with one or two gonothecæ. A single large sporosac occupied the interior, in the centre of which was a somewhat flask-shaped, opaque body, terminating above in a narrow neck (Plate XLV. fig. 2 *d*) : this was probably the spermary.

Ophiodes mirabilis, it will be seen, exhibits a large number of interesting characters.

The distinct funnel-shaped head crowning the tapering body, and itself crowned by the tentacular verticil with its battery of thread-cells at every embrasure, the elegant calycle, the strange snake-like organ near it, either resting motionless and sentinel-like, or twisting vehemently about and casting abroad its fatal threads, and the numerous similar organs below, writhing and lashing themselves about, without apparent object, constitute a really remarkable group of curious structures.

Hab. On weed, dredged in shallow water (5–8 fathoms), Swanage Bay, Dorset; Ilfracombe, chiefly on *Laminaria*-roots and stems, from the lower ledges on the Capstone, very abundant (T. H.).

Family VIII.—Sertulariidæ.

HYDROTHERCÆ *perfectly sessile, more or less inserted in the stem and branches*; POLYPITES *wholly retractile, with a single wreath of filiform tentacles round a conical proboscis*; GONOOIDS *always fixed*.

Fig. 28.

*S. fusiformis* (Hincks).*S. tenella* (Alder).

Genus SERTULARELLA, Gray.

Der. Diminutive of *Sertularia*.

SERTULARIA auct. (in part).

COTULINA, Agassiz, N.H. United States, iv. 356 (for *S. polyzonias* only).AMPHITROCHA, Agassiz, ibid. iv. 356 (for *S. rugosa*).

GENERIC CHARACTER.—Zoophyte plant-like; stem more or less branching, jointed, rooted by a creeping stolon; hydrothecæ biserial, decidedly alternate, with a toothed orifice, and an operculum composed of several pieces; gonothecæ scattered, transversely ringed, slightly dissimilar in the two sexes.

THE genus *Sertularella* was constituted by Gray, to include that Section of the *Sertulariæ* of which *S. polyzonias* may be regarded as the type. Only two British species had been recognized at the time of the publication of his list; but the number has since been increased to six. In other parts of the world the group is largely represented; and the examination of many foreign forms has led me to retain the genus. The decidedly alternate arrangement

of its calyces is accompanied by a peculiar and characteristic habit of growth. The *physiognomy*, indeed, of the group is very striking, and the principal characters are well marked. The calyces have always a toothed orifice, and are closed by a somewhat prominent operculum composed of several convergent pieces. The reproductive capsules, whilst exhibiting many varieties of form, are always more or less wrinkled or ringed transversely; they have usually a denticulate aperture. The male and female only differ in size and in the nature of their contents.

The type species (*S. polyzonias*) seems to be very generally distributed. Two or three of our British forms range to the extreme north, and *S. tricuspidata* may be said to have its metropolis there. In the same region a remarkable variety of *S. polyzonias* occurs, of a very robust habit and having its calyces more than double the usual size. I have specimens from Iceland; and Sars has obtained it near the North Cape. He also states that he has received the same variety from Massachusetts, U.S.

The genus is represented in the South Seas by a number of forms distinct from those of Europe. One of them (the *S. Johnstoni*, Gray) makes a near approach to our *S. tricuspidata*.

1. *S. POLYZONIAS*, Linn.

"GREAT TOOTH CORALLINE," *Ellis*, Corall. 5, pl. ii. figs. *a* A, *b* B, and pl. xxxviii. figs. 1 & A.

SERTULARIA POLYZONIAS, *Linn.* Syst. x. 813; *Esper*, Pflanzenthierc, Sert. t. vi. figs. 1-6; *Lamk.* An. s. Vert. (2nd ed.) ii. 142; *Lamx.* Cor. flex. 190; *Johnst.* B. Z. 61, pl. x. figs. 1 & 3; *Dalyell*, Rem. An. i. 134, pl. xxii.

„ FLEXUOSA, *Linn.* Syst. x. 814, no. 34.

„ ERICOIDES, *Pall.* Elench. 127.

„ PINNATA, *Templeton*, Mag. N. H. ix. 468.

„ HIBERNICA, *Johnst.* B. Z. (1st ed.) 128.

„ ELLISH, *M.-Edwards*, Lam. An. s. Vert. (2nd ed.) ii. 142; *Johnst.* B. Z. (1st ed.) 123.

SERTULARELLA POLYZONIAS, *Gray*, B. M. Radiata, 68.

COTULINA POLYZONIAS, *Agassiz*, N. H. U. S. iv. 356.

Plate XLVI. fig. 1.

STEMS *slender, slightly waved, irregularly branched*; BRANCHES *subflexuous*, alternate, but *produced at unequal distances, often themselves much and variously branched*, jointed obliquely; HYDROTHECÆ placed immediately below the joints, distant, *urceolate, bulging below, above free and divergent, with a wide, everted and 4-toothed aperture*; GONOTHECÆ produced at the base of the calyces, *large, ovate, wrinkled transversely, with a tubular quadridentate orifice*, and shortly stalked.

S. POLYZONIAS presents many varieties of size and habit; but the shape and arrangement of the calyces suffice for its identification amidst them all. It is often of very luxuriant growth, forming large, arborescent masses, which exhibit the most complex ramification. The main portion in such cases sends off at intervals long, slender shoots, which in their turn originate a whole system of offshoots, each of them much branched, the whole constituting a perfect tangle of interlacing stems. Such masses, when freshly cast upon the shore, and before the evanescent colour has faded, have a certain exquisitely delicate beauty, and may almost be said to glitter on the dark heaps of seaweed. Between tide-marks the species is of much humbler growth.

When living, *S. polyzonias* is of a bright straw-colour and is certainly one of the prettiest, as it is one of the most generally distributed, of the Hydroids. It is a littoral as well as a deep-water species, having a wide range bathymetrically no less than in space. It is in truth a cosmopolitan form, having been met with in most parts of the world.

The polypites are large, and have 20 or more tentacula. The female reproductive capsule contains a

single sporosae; and the eggs at a certain stage of their development are discharged from it into an external marsupium, in which they are matured into free, ciliated embryos (*planulæ*). Ellis, with his accustomed accuracy, has figured it in this condition, surmounted by the delicate sac crowded with the ripening ova.

The male and female capsules differ considerably in size, the former being the smaller and of a whitish colour, whilst the female are coloured yellow by the contents.

Hab. On shells, seaweeds, &c.; generally distributed round our coasts.

[Massachusetts, robust var.; Greenland, do. (Sars): Iceland, do. (T. H.): Newfoundland (Landsborough): Straits of Belle Isle, between tide-marks, common, in deeper water very stout and large (A. S. Packard, jun.): Grand Manan, Bay of Fundy (Stimpson): Madeira; South Africa; Falkland Islands (Busk): Red Sea (T. H.): La Charente inférieure (Beltremieux): Lussin Piccolo, Adriatic (Grube): Mediterranean (Cavolini).]

2. S. GAYI, Lamouroux.

SERTULARIA GAYI, *Lamx. Expos. Méth.* 12, tab. lxvi. figs. 8, 9; *Hincks*, Cat. Devon and Corn. Zooph., Ann. N.H. (3rd ser.) viii. 252; *Alder*, Cat. North. Zooph., Suppl., in Trans. Tynes. F. C. v. 236.

„ ERICOIDES, var., *Pall. Elench.* 128.

LA SERTULAIRE DE GAY, *Blainv. Man. d'Actinol.* 481.

SERTULARIA POLYZONIAS, var. β , *Johnst. B. Z.* 61, pl. x. fig. 2.

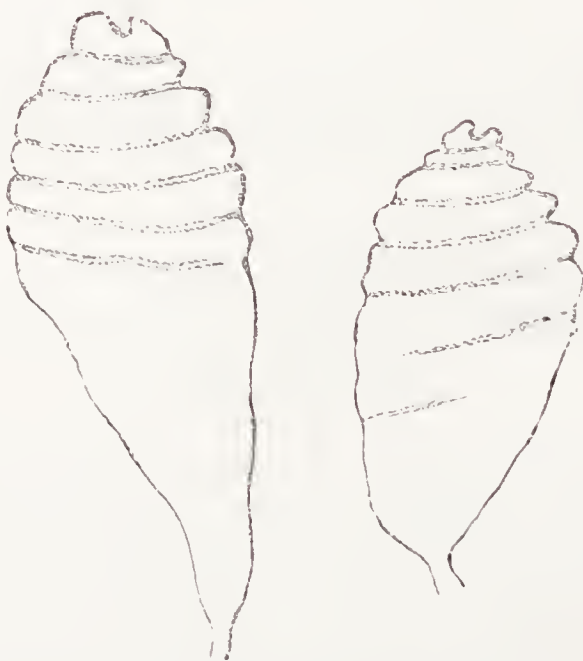
Plate XLVI. fig. 2.

SHOOTS *erect, composite*, pinnate; BRANCHES alternate, *approximate*, obliquely jointed, of various lengths, giving off ramules here and there; HYDROTHECÆ urceolate, distant, one to each internode, *frequently wrinkled*, swollen below, narrower and divergent above, with a 4-toothed aperture; GONOTHECÆ *elongate, ovate, tapering towards*

the aperture and the base, somewhat compressed, strongly ringed above, the lower portion smooth—aperture small, with two denticles.

THE *S. Gayi* of Lamouroux was regarded by Dr. Johnston as a variety of the somewhat protean *S. polyzonias*; but after some consideration, I venture to restore it to specific rank. In habit it is sufficiently distinct. The stems are thick and coarse, made up of many fibres agglutinated together, erect, and rigid, and wanting altogether the sub-flexuous character of the allied species. They are pinnate, the pinnæ springing alternately at regular intervals and very close together, whereas in *S. polyzonias* the branches are distant and irregularly distributed. The calyces differ but slightly in the two species. Those of *S. Gayi* are somewhat stouter, and frequently wrinkled transversely. The capsules afford a good specific character. They are rather smaller and more slender than those of *polyzonias*, compressed, tapering very decidedly towards the apex, and wanting the tubular orifice (Woodeut, fig. 29). The

Fig. 29.



aperture is smaller, and bears only two opposite denticles

on the margin, instead of the four teeth which occur in the preceding species. The ringing, which is very marked, covers only the upper third of the capsule, the inferior portion being perfectly smooth.

S. Gayi ranges in height from about 4 to 10 inches. It is a deep-water form. Pallas describes it, under his *S. ericoides*, as “*elegantissimam omnium varietatem.*”

Hab. Cornwall, not uncommon; climbing over *Gorgonia*, from 60 fathoms, off the Deadman; amongst the refuse of the Plymouth trawlers (T. H.): Isle of Wight (Solander): Norfolk and Suffolk (C. W. P.): Durham and Northumberland, occasionally in deep water (J. A.): Peterhead and Wick (C. W. P.): Shetland (A. M. N.): Birterbuy Bay, Connemara (G. S. Brady): Dublin Bay.

[Coast of Normandy (Gay).]

3. *S. TRICUSPIDATA*, Alder.

SERTULARIA TRICUSPIDATA, *Alder*, North. and Durham Cat. in Trans. Tynes.

F. C. iii. 111, pl. iv. figs. 1, 2.

„ ERICOIDES, *Esper*, Pflanzth. Sertul. pl. xii. figs. 1, 2.

Plate XLVII. fig. 1.

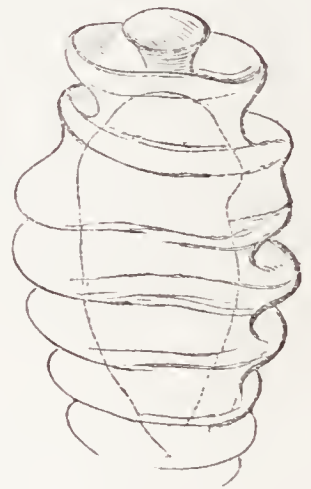
STEMS *slender*, alternately branched, or divided dichotomously, often bipinnate at the top, *jointed above each calycle, and twisted at intervals*; HYDROTHECÆ *distant, cylindrical, smooth, slightly expanded and everted above, with a 3-toothed aperture*: GONOTHECÆ *large, strongly ribbed across, with a plain funnel-shaped aperture, which rises from the centre of a bowl-like expansion.*

THIS species is separated from *S. polyzonias* by a group of well-marked characters. It is of exceedingly delicate habit, of a light brown colour, and attains a height of about 2 inches. The mode of growth is irregular. Sometimes the branches are alternate, and often themselves

much branched; sometimes the stems divide dichotomously, and frequently terminate in a fork. The calyces are narrow and cylindrical—not swollen at the base. The rim of the aperture rises into three strong denticles, the largest in front, and the others on the sides. The margin is somewhat thickened.

The capsules, which are very large in proportion to the size of the calyces, are less inflated than those of *polyzonias*, and much more strongly ribbed transversely. The sides are cut into deep dentations between the rings, which extend uniformly from top to bottom. At the upper extremity the capsule expands into a kind of bowl, and from the centre of this rises a narrow funnel-shaped aperture with a plain rim.

Fig. 30.



S. tricuspidata has only been found in the north. Amongst some dredgings, obtained in 100 fathoms, near Reikiavik, in Iceland, it occurs in great abundance and of unusual size. The specimens from this locality bear the reproductive capsules in profusion, their branches being frequently laden with them throughout their whole extent. They were taken up amongst "icebergs, grounded and drifting." It is probably this species which Mr. Busk has figured in the 'Microscopical Journal,' from a specimen procured in Greenland, under the name of *S. polyzonias*.

Hab. Parasitical on other zoophytes, "from the deep-water boats that supply Newcastle market with fish during the spring months; not rare" (J. A.).

[Off Reikiavik, Iceland (T. H.): Greenland (Busk): Straits of Belle Isle, in 40 fathoms, abundant (A. S. Packard, jun.).]

4. S. RUGOSA, Linnæus.

"SNAIL TREFOIL CORALLINE," *Ellis*, Cor. 26, tab. xv. figs. *a*, A.

SERTULARIA RUGOSA, *Linn.* Syst. 1308; *Pall.* Elench. 126; *Esper*, Pflanz.

Sert. tab. xi. figs. 1-4; *Lamk.* An. s. Vert. (2nd ed.) ii. 149;

Johnston, B. Z. i. 63, pl. x. figs. 4-6.

CLYTIA RUGOSA, *Lamx.* Cor. flex. 204.

SERTULARIA PATAGONICA, *D'Orb.* Amér. Mérid.

SERTULARELLA RUGOSA, *Gray*, List of Brit. Mus. Radiata, 69.

AMPHITROCHIA RUGOSA, *Agassiz*, Nat. Hist. U. S. iv. 356.

Plate XLVII. fig. 2.

SHOOTS *small, gregarious, simple or very sparingly and irregularly branched*; STEMS annulated at the base and between the calyces; HYDROTHECÆ *crowded, barrel-shaped, strongly wrinkled transversely, narrowed towards the quadrangular aperture, which is set obliquely and looking outwards, and is furnished with four very minute denticles* and a quadripartite opereulum; GONOTHECÆ *very large, ovate, strongly ribbed across, with a 4-toothed aperture.*

THERE are two forms of this species. In the larger and more luxuriant the creeping stem sends up numerous crowded shoots, commonly less than an inch in height, which are very scantily branched. They are bare for some distance above the base, and strongly annulated. Throughout the rest of their length they are covered with the short barrel-like calyces, which are closely set, the small intervening spaces being also more or less ringed. The other is a dwarf variety.

The capsules are three or four times as large as the hydrothecæ. They are generally described as having a tridentate aperture; but there are, I believe, four teeth, one of much smaller size than the rest.

Hab. Most frequently parasitic on *Flustra foliacea*; also on seaweed, zoophytes, &c., from low-water mark to deep water; common.

[Greenland (Fabricius): North Cape, between tide-marks (Sars): Square Island, Labrador, in 30 fathoms, rare (A. S. Packard, jun.).]

5. *S. TENELLA*, Alder.

SERTULARIA RUGOSA, var., *Johnst.* B. Z. 64 & 62, fig. 8 c.

„ TENELLA, *Alder*, North. Cat. in Trans. Tynes. F. C. iii. 113, pl. iv. figs. 3-6.

Plate XLVII. fig. 3.

ZOOPHYTE *minute*; STEMS *short*, slender, simple or slightly branched, *zigzagged*, and *jointed and twisted above each calycle*; HYDROTHECÆ rather distant, *elongate, barrel-shaped, finely ribbed across, the aperture erect, patent, squared, 4-toothed*, and closed by a four-sided operculum; GONOTHECÆ ovate, slender, ringed transversely, produced above into a short tubular orifice.

“THIS pretty little species is smaller and more delicate in all its proportions than *S. rugosa*, with which it has hitherto been confounded. The cells are more erect, narrower, and more closely and regularly ribbed or wrinkled across, the wrinkles generally rising a little opposite each angle; there are six or seven in this species; in *S. rugosa* three or four.” In the latter “the aperture is much less prominent, and *always bent outwards*.” The cells of *S. tenella* “are more distant than those of *S. rugosa*,” in this respect resembling *S. polyzonias*; but they are more slender and elongated than in either species. The “polypes appear to be yellow or orange-colour.” (*Alder*.)

Hab. Northumberland, on *Plumularia falcata* and other zoophytes, but not common (J. A.): South Devon, between tide-marks; Filey, Yorkshire (T. H.): Peterhead,

occasionally (deep water); Wick, on other zoophytes (C. W. P.): Hebrides; Shetland, on *Tubularia indivisa* (A. M. N.).

6. S. FUSIFORMIS, Hincks.

SERTULARIA FUSIFORMIS, Cat. Devon and Corn. Z. 11, pl. vi. figs. 7, 8, Annals N. H. (3rd ser.) viii. 253, pl. vi. figs. 7, 8.

Plate XLVII. fig. 4.

STEMS *slender, slightly zigzag*, generally simple, *annulated at the base and below each calycle*; HYDROTHECÆ *bent in opposite directions, elongate, somewhat flask-shaped, smooth*, one to each internode, *aperture quadridentate*, operculum composed of four pieces—*each internode, with its calycle, of a fusiform figure*; GONOTHECÆ *elongate ovate, slender, ribbed across, produced at the upper extremity into a short neck, and toothed*.

Height from $\frac{1}{4}$ of an inch to 1 inch.

THIS minute zoophyte presents the appearance of a series of fusiform pieces, springing one from the side of the other about midway, and bending alternately in opposite directions. Its nearest ally is the *S. tenella*. It is one of the company of pigmy forms, as exquisite as they are minute, which reward a diligent search amongst the chinks and crannies of the tidal pools.

Hab. Between tide-marks, on rocks, South Devon; under one of the lower ledges, Capstone, Ilfracombe (T. H.): Torbay (E. Parfitt): Hebrides (A. M. N.).

Genus DIPHASIA, *Agassiz*.

SERTULARIA (auct.) (in part).

DYNAMENA, Lamouroux (in part).

GENERIC CHARACTER.—*Zoophyte plant-like; stem more or less branching, jointed, rooted by a creeping stolon; hydrothecæ opposite, a pair on each internode, occasionally subalternate, with an internal, valve-like operculum; gonothecæ scattered, differently shaped in the two sexes—the female ample, more or less cleft or divided into segments above, containing a marsupial chamber; the male smaller, with a central tubulous aperture.*

OF this beautiful genus *D. rosacea* may be taken as the type; it strikingly represents the characteristics of the group. *Diphasia* agrees generally with one section of the genus *Sertularia* in the arrangement of its calyces; but they are furnished with a plain or rarely an obscurely toothed aperture, while in the latter they are decidedly bilabiate or mucronate. But the chief distinction is found in the structure of the reproductive capsules, which exhibit great uniformity throughout the genus, and differ essentially from those of the allied groups.

In all the species of *Diphasia* the female gonotheca encloses a more or less spheroidal chamber or marsupium, which surmounts the axial column, and into which the contents of the several sporosacs are successively discharged (Plate XLVIII. fig. 1, *d*). The uppermost portion of the capsule, immediately surrounding this chamber, is always cleft or divided into segments, either free or slightly adherent, which open for the passage of the planules when mature. The external form varies in the different species; but these points of structure are constant.

The male gonotheca exhibits universally the same general figure. It is usually much smaller than the female, and

in the centre of its upper surface there is always a raised tubular orifice, which is surrounded by several spinous projections.

This genus has been named by Agassiz, but he has given no definition of it; he merely refers to the cleft border of the gonotheca as the prominent feature. He has ranged under it nearly all our British species, but wrongly associates with them *Sertularia fusca*, which is referable to a very different type.

1. D. ROSACEA, Linn.

“LILY OR POMEGRANATE-FLOWERING CORALLINE,” *Ellis*, Cor. 8, pl. iv. figs. *a*, A.
SERTULARIA ROSACEA, *Linn.* Syst. 1306; *Esper*, Pflanz. Sert. tab. xx. figs. 1-3;
Lamk. An. s. Vert. ii. 119; *Johnst.* B. Z. 64, pl. xi. fig. 1; 468.
fig. 83.

„ NIGELLASTRUM, *Pull.* Elench. 129.

DYNAMENA ROSACEA, *Lamx.* Cor. flex. 175.

DIPHASIA ROSACEA, *Agassiz*, iv. 355.

Plate XLVIII. fig. 1.

SHOOTS *very slender* and delicate, *of a white or pale horn-colour*, branched, the branches alternate, distant, unequal, internodes constricted at the base; HYDROTHECÆ *long and tubular, the upper portion free and more or less divergent*, aperture oblique, entire; GONOTHECÆ (female) *pear-shaped, tall, shortly stalked, with eight longitudinal ridges, terminating above in spinous processes of various lengths, the outer one on each side much the longest, lanceolate, incurved, with a notch on the outer edge, the remainder short, crowded, and converging towards the central aperture*; (male) pyriform, curved towards the base, *traversed by longitudinal lamellated ridges, which rise above into spinous points around a slender tubular orifice.*

S. ROSACEA is remarkable amongst its kindred for slenderness of habit and for its delicate, papyraceous texture. It

is generally of a pellucid whiteness, and throws about its stems and branches in the most graceful curves.

There is some variation in the degree in which the free portion of the calycle diverges; in some specimens it bends abruptly outwards, in others it rather inclines upwards. The internodes also are more or less produced and attenuated below, and are often much constricted at the joint. The operculum of the calycle is placed a little below the aperture, and shows distinctly through the delicate walls, giving the appearance of a transverse fold or crease.

The gonothecæ* in an early stage are in the form of an inverted cone, traversed by eight longitudinal ridges that terminate above in as many angular projections (Plate XLVIII. fig. 1, *c*). In the perfect state, the female capsule encloses an oval marsupial chamber, formed by eight radiating, chitinous tubes, which originate at the summit of the column bearing the ovarian sacs. The ova are transferred from these sacs successively into the chamber, and there pass through the later stages of their development†. Allman describes the male gonothecæ as having only six of the longitudinal ridges; but in all that I have examined there were eight, as in the female. There are generally from four to six sperm-sacs in each, forming a row, which extends to the very top of the cavity.

The capsules are sometimes borne in continuous lines along the upperside of the pinnæ, springing from the base of each pair of calycles.

Hab. On other zoophytes (chiefly) and on shells; gene-

* "Large and peculiar vesicles, alike difficult to be described and represented, are borne by the *Sertularia rosacea*."—*Dalyell*.

† *Vide* Prof. Allman's "Report on the Reproductive System in the Hydroids," Report Brit. Assoc. for 1863, pp. 372-3.

Lieut. Thomas also has given a very accurate account of the structure of the gonotheca, in the Supplement to Johnston's 'Zoophytes,' pp. 468-9.

rally distributed. It ranges from between tide-marks to deep water.

[Very abundant in 50 fath., gravelly bottom, in the Straits of Belle Isle (A. S. Packard, jun.): Massachusetts Bay (Agassiz).]

2. D. ATTENUATA, Hincks.

SERTULARIA ROSACEA, *Ellis*, Cor. 9, pl. iv. fig. C?; *Johnst.* B. Z. 470 (specimen from Orkney, Lieut. Thomas).

„ PINASTER, var., *Johnston*, B. Z. 72, figs. c, d.

„ ATTENUATA, *Hincks*, On new British Hydroida, *Annals N. H.* for October 1866, (3rd ser.) xviii. 298.

Plate XLIX. fig. 1.

STEMS *straight, somewhat rigid*, pinnately branched, *often running out above into long tendril-like filaments*, which are thickened and bifid at the extremity; branches simple, or bearing one or two ramules, alternate, inclined upwards, sometimes furnished with tendrils; HYDROTHECÆ *tubular, slender and gracefully curved, about half their length free and divergent, but not abruptly bent, with a plain, suberect aperture*; GONOTHECÆ (female) *elongate-pyriform*, tapering off below, and gradually expanding upwards, *bristling with strong spines above, which are arranged on six longitudinal ridges, and extend down the upper third of the capsule*; (male) ovate, with six longitudinal ridges, terminating above in angular points, the aperture subconical, rising in the midst of them.

THIS pretty species has been confounded with *D. rosacea*, to which it bears some general resemblance. The habit and texture of the two, however, are strikingly distinct; so are the reproductive capsules, and there are also differences, though minute, in the form and arrangement of the calyces. *D. attenuata* is more robust and rigid and

of larger growth than its ally, and wants its delicate, membranaceous texture. The calyces do not shrivel in drying as those of *D. rosacea* do. The stems are much firmer, and of a decided horn-colour; they are commonly furnished with long tendril-like extremities. These are occasionally met with on *D. rosacea* as on other species, but they are very characteristic of *D. attenuata*. The tendrils are composed of a number of oblong pieces separated by joints (Plate XLIX. fig. 1, *d*).

The branches are often long and slightly curved upwards, and exhibit the same comparative rigidity as the main shoots. It is more difficult to describe the differences in the calyces. Those of *D. attenuata* are longer and more slender, and slightly suberect towards the aperture, which is smaller and less “*flaring*” than in the allied species; they curve gracefully and gradually outward, and do not bend abruptly. But the chief distinction is to be found in the gonothecæ, which seem almost top-heavy with their profuse garniture of spines, some of them long, slender, and acuminate, others shorter and stouter, and wrinkled transversely. There are generally three on each ridge, the uppermost being the largest and rising considerably above the aperture. The capsules are sparingly produced.

After entering into these details, it must be added that what may be called the *expression of the species* will enable the student readily to recognize *D. attenuata*. Its erect and somewhat stiffer habit, its decided horn-colour contrasting with the pearly whiteness of *rosacea*, its slenderer branches, its more erect and regularly pinnate form, and its long tendrils will at once betray it to a quick eye.

This form has been noticed by several previous authors, but has been accounted a mere variety. Ellis has figured it with the female capsule, referring it to *rosacea* (pl. iv.

fig. C). Dr. Johnston's woodcut (fig. 12, *c*, *d*, page 72) represents the male, which he strangely identifies with *pinaster*, in spite of the totally different calyces; and Couch evidently refers to it when he says, in his remarks on *D. rosacea*, "In a specimen before me the *gemmules*, though ripe, are not yet excluded, and the spines not only surround the upper edge of the vesicle, but are scattered over one-third of the upper surface" *.

Hab. Generally on other zoophytes; Ilfracombe; Swanage, Dorset, common; Filey; Whitby (T. H.): Gorran Haven, Cornwall; Peterhead (C. W. P.): Brighton (Ellis): South Devon (Parfitt).

[In Mr. Busk's collection there is a fine specimen from Port Adelaide, about an inch in height.]

3. *D. FALLAX*, Johnston.

DYNAMENA PINNATA, *Flem. Br. An.* 545.

SERTULARIA PINNATA, *Johnst. B. Z.* (1st ed.) 127, pl. ix. figs. 5, 6.

„ FALLAX, *Johnst. B. Z.* (2nd ed.) 73, pl. xi. figs. 2, 5, 6.

DIPHASIA FALLAX, *Agassiz, N. H. U. S.* iv. 355.

Plate XLIX. fig. 2.

STEMS *thick, pinnate; branches alternate*, sparingly branched, springing from the front of the stem and arching outwards—the main shoots and many of the branches terminating in tendril-like claspers; HYDROTHECÆ *shortly tubular, the upper part free for a little way and slightly divergent*, with a wide plain aperture, the inner margin of which is somewhat sinuated; GONOTHECÆ (male) *elongate, slender, tapering towards the base, expanding upwards and bearing four stout and erect spines, which surround the raised tubular aperture*; (female) *ovate, deeply cleft above into four convergent leaf-like segments*.

* Cornish Fauna, part. iii. p. 19.

IN its ordinary condition *D. fallax* presents an elegant plumous form, the main shoots being often gracefully re-curved, and the branches arching outwards from their point of departure on the front aspect of the stem. The large number of tendrils, elegantly curled and thickened at the extremity, with which it is furnished, give it a very marked and peculiar appearance. No other species rivals it in this respect. The stems are often dark-coloured. Luxuriant specimens occur in which the simple plume-like aspect altogether disappears, and the main stem is thickly set with long branches, each of which is itself pinnate. An example of this kind now before me, which is 2 inches high, has more than a dozen plumous branches down each side, and is provided with between thirty and forty of the tendril-like filaments. This species is of a delicate whiteness when fresh, but becomes dark-coloured in drying, and in this state has usually a glossy or varnished appearance. The male capsule has not hitherto been described. It is, as usual, much smaller than the female, and presents the general appearance which is characteristic of this sex throughout the genus (Woodcut,

Fig. 31.

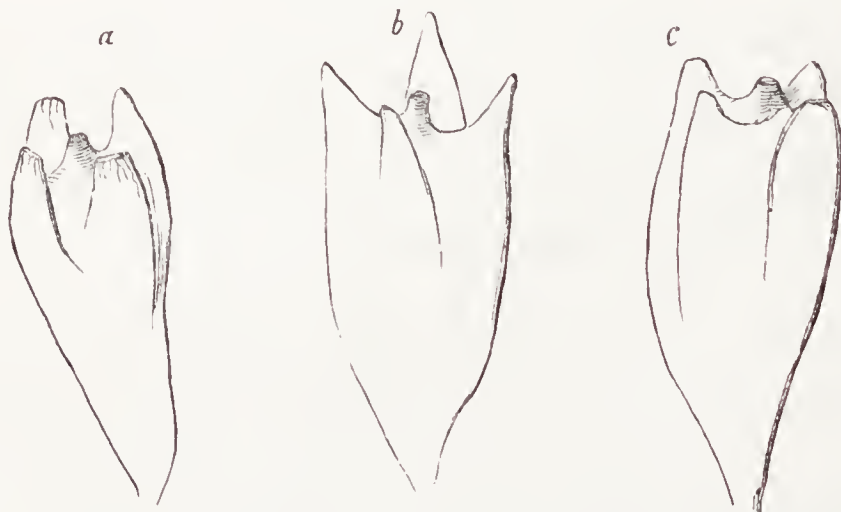


fig. 31). The female capsule contains a somewhat spherical marsupial chamber, embraced by a number of tubular

processes, and protected by four long and pointed segments, into which the upper part of the capsule is cleft. These originate a good way down, and may be traced in an early stage of the development; they are not adherent, but converge above and so close the aperture, opening readily for the passage of the embryo. We have here a modification of the structure already described in the case of *D. rosacea*. The circulation of the nutrient fluid may be traced in the tubes which surround the marsupium. I have seen as many as six finely ciliated planules moving freely about within the cavity of the sac.

A specimen in my possession bears capsules of both sexes, the female occupying the upper portion of the shoot, and the male being distributed over the lower branches,—another case of departure from the diœcious condition which is usual amongst the Hydroida.

Hab. Commonly parasitic on other zoophytes, to which it binds itself by means of its numerous tendrils. It is a northern species, ranging from the coast of Yorkshire to Shetland, and an inhabitant of deep water. Filey, abundant (T. H.): Scarborough (Mr. Bean's collection contains very splendid specimens, composed of many large shoots united together); Northumberland and Durham, frequent (J. A.): Firth of Forth, plentiful (Dr. Coldstream): Loch Fyne (A. M. N.): coast of Aberdeen (Macgillivray): Peterhead, plentiful; Wick, much rarer (C. W. P.): Orkney Islands, 35 fathoms; Buehanness, 40 fathoms (Lieut. Thomas): Hebrides; Shetland, 40 fathoms (A. M. N.).

[Tromsö, in 30 fathoms, rare; commoner at Bergen on stems of *Laminaria* (Sars): Grand Manan; "a few specimens, probably of this species, were taken in deep water" (Stimpson): Massachusetts Bay (Agassiz).]

4. D. PINASTER, Ellis & Solander.

SERTULARIA PINASTER, *Ellis & Solander*, Zooph. 55, t. vi. fig. 6 B; *Johnst.* B. Z. 71, 72, fig. 12 *a, b*; *Alder*, Northumb. Cat. in Trans. Tynes. F. C. iii. 114.

DYNAMENA PINASTER, *Lamx.* Exp. Méth. 12, t. vi. figs. *b*, B.

DIPHASIA PINASTER, *Agassiz*, N. H. U. S. iv. 355.

SERTULARIA MARGARETA (the female), *Hassall*, Ann. & Mag. N. H. vii. 284, pl. vi. figs. 3, 4; *Johnst.* B. Z. 72, 73, fig. 13; *Hincks*, Devon and Cornw. Cat., Ann. N. H. (3rd ser.) viii. 254.

DIPHASIA MARGARETA, *Agassiz*, N. H. U. S. iv. 355.

Plate L. fig. 1.

STEMS *erect and somewhat rigid*, regularly pinnate; pinnæ alternate, often of great length, with occasionally a few branchlets; HYDROTHECÆ *tubular, the inferior half adherent, the superior abruptly divergent* and slightly curved upwards, *with a distinct fold at the point of divergence*; aperture plain and circular; GONOTHECÆ (male) ovate, subpedicellate, quadrangular above, each angle produced at the top into a spine; (female) *oval, shortly stalked, domed above, with four longitudinal ridges and eight spines borne on the ridges and arranged in two circles, one near the top and the other somewhat lower down.*

Two species have been made out of this well-marked form, founded on mere differences of sex, which had not been recognized when Dr. Johnston's work was published. The *Sertularia Margareta* of Hassall is the female of the *S. pinaster* described and figured by Solander. This species is of somewhat rigid habit, and, when dried, of a light horn-colour. When fresh it is of a delicate pearly whiteness, and when laden with the yellow capsules, which stand erect in rows along the pinnæ, is a most beautiful object. The creeping stem sends up pinnate, plume-like shoots from 2 to 6 inches high, that are either single or bear similar shoots at irregular intervals, which, as Dr. Johnston well said, "appear rather to grow on the rachis

than to grow *out* of it." Occasionally the main stem divides dichotomously very near the base, each arm dividing again, and sometimes subdividing in the same fashion, so as to form a compound specimen. Sometimes a tall stem, pinnate at the top, but bare throughout the greater portion of its length, carries a number of long plumous shoots, springing from it in various directions, so as to give a very straggling habit to the whole. The pinnæ occasionally bear a few branchlets, but are more generally simple. Under every variety of growth this species may be recognized by its calyces. The abrupt divergence of the upper half causes a somewhat deep central depression in the outer edge, which is accompanied by a distinct fold. The divergent portion curves outwards and is slightly concave on the superior side.

As usual, the female capsules are much larger in all their dimensions than the male; they are both borne along the upperside of the branches and at the base of the calyces.

Hab. There has been so much confusion respecting this species, that localities must be taken with caution. It seems, however, to be widely distributed.

Shetland; Hebrides (A. M. N.): off Sana Island, in 40 fathoms (Hyndman): Clyde district (Forbes): Oban Bay, abundant (T. H.): Arran (Landsb.): off the Mull of Galloway, in 110–140 fathoms (Capt. Beechey): Embleton Bay, Northumberland, deep water (R. Embleton): Dogger bank (J. A.): Mersey (Tudor and Dr. Collingwood): Devonshire (Mrs. Griffiths): Jersey (A. M. N.): Ireland, Belfast Bay (Hyndman): Dublin Bay (W. T.): Giants' Causeway (Hassall).

5. *D. TAMARISCA*, Linnæus.

"SEA TAMARISK," *Ellis*, Corall. 4, pl. i. figs. *a*, *A*.

SERTULARIA TAMARISCA, *Linn. Syst.* 1307; *Pall. Elench.* 129; *Lamx. Cor.* flex. 188; *Lamk. An. s. Vert.* (2nd ed.) ii. 153; *Johnst. B. Z.* 74, pl. xiii. figs. 2, 3, 4.

DYNAMENA TAMARISCA, *Flem. Br. An.* 543.

DIPHASIA TAMARISCA, *Agassiz, N. H. U. S.* iv. 355.

Plate LI.

SHOOTS *stout and erect*, irregularly branched, the branches commonly alternate, sometimes opposite, long, simple or variously branched; HYDROTHECÆ *very large, cylindrical, the upper half free and divergent, with a wide, tridentate aperture*; GONOTHECÆ (male) *compressed, obcordate*, attenuated below, broad and truncate above, *with a small spine at each side*, and a central tubular aperture; (female) *elongate, oval below, above three-sided, with a pyramidal summit, the edges of the pyramid serrated, and its basal angles produced into spines*.

D. TAMARISCA is distinguished by its robust habit and the large size of its tubular calyces, which give a strongly serrated appearance to the stems and branches. They are of a thin, transparent, corneous texture. The ramification is irregular—long, simple branches alternating with others, which are pinnate or bipinnate. The branches frequently do not lie in the same plane as the stems, but spring from them in various directions, so as to give a somewhat shrubby appearance. The mode of growth is straggling and irregular.

The capsules are produced abundantly, and often line the branches in conspicuous rows. The male and female are commonly borne, it would seem, on distinct colonies; but this is not universal, as I have a specimen on which they are intermingled. The former, which alone were known to Ellis and Johnston, are somewhat in the shape of a heart, attached by its pointed end. The tubular orifice

risers in the centre of the upper extremity, which is broad and truncate, and produced at each side into a more or less developed spine. They are often slightly furrowed transversely. The male capsules form rows on the branches, partly overlapping one another.

The female capsule is of much larger size, and presents a complex internal structure, which has been minutely described by Professor Allman*. It consists of two chambers, the lower of which is traversed by the column bearing the ovaries. This is surmounted by an upper story, which encloses a marsupial sac, surrounded by a number of branched cæcal tubes. The portion of the capsule which forms a protective case for the marsupium is composed of three detached pieces that converge above. The summit is pyramidal. After the liberation of the embryos the top of the capsule presents a very ragged appearance.

D. tamarisca often attains a large size.

Hab. On shells and stones from deep water. Though not an abundant species, *D. tamarisca* is very widely distributed. It occurs in Ireland.

[La Charente Inférieure, Bay of Biscay, common (Beltremieux): Grand Manan (Stimpson): Massachusetts Bay (Agassiz).]

6. *D. PINNATA*, Pallas.

SERTULARIA PINNATA, *Pallas*, *Elench.* 136; *Johnst. B. Z.* 69, pl. xii. figs. 3, 4, and woodcuts, 69. figs. *b, b*.

„ FUSCESCENS, *Turt.*, *Gmel.* iv. 677; *Lamx. Cor. flex.* 195.

NIGELLASTRUM PINNATUM, *Oken*, *Lehrb. Nat.* 93.

DIPHASIA PINNATA, *Agass.* N. H. U. S. iv. 355.

SERTULARIA NIGRA (the female), *Pall.* *Elench.* 135; *Johnst. B. Z.* 68, pl. xii. figs. 1 & 2, and woodcuts, 69. figs. *a, a*.

* "Report on the Reproductive System in the Hydroida," British Assoc. Report for 1863, pp. 373-4.

NIGELLASTRUM NIGRUM, *Oken*, Lehrb. Nat. 93.

DIPHASIA NIGRA, *Agass.* N. H. U. S. iv. 355.

Plate LII.

SHOOTS pinnate, somewhat lanceolate, deep red or pink when living, drying black or reddish brown; STEMS straight, tapering towards the tip, compressed, delicately serrated; pinnæ simple, alternate or sometimes opposite, not constricted below the calyces, much attenuated towards the base, often greatly elongated; HYDROTHECÆ subalternate, or sometimes opposite, small, crowded, tubulous, adherent, slightly everted at the top, with a wide, even aperture; GONOTHECÆ (male) ovate, tapering to a blunt point below, with a number of short denticles at the top, round the central papillary aperture; (female) ample, subsessile, smooth and varnished, obovate, divided by longitudinal lines, which meet at the apex, into four lobes.

THE *Sertularia pinnata* and *S. nigra* of Pallas must be united as one species, the only differences between them being dependent upon sex. The former specific name, which Pallas applied to the male, and which is preferable in itself, may be retained.

The shoots, which attain a height of 6 inches or upwards, spring from the midst of a twisted and tangled mass of fibres, which sometimes involves the lower part of the stem for a considerable distance*. A sheaf of many plumes is often bound together at the base in this way. The species varies in habit. In some cases the shoots are plumous in form, elongate and slender; in others the pinnæ are enormously produced, giving a breadth of as much as 3 inches. The pinnæ taper off very finely towards the point of origin, becoming suddenly thicker above it, and continuing of equal width to the extremity. There is no constriction below the calyces as in all the

* Tubi intestinuliformes, implexi, usque ad pinnarum originem assurgentibus."—*Pallas*.

preceding species; *D. pinnata* deviates in this respect from the typical character of the genus. Its hydrothecæ are not arranged in pairs, separated from each other by a distinct joint, but are closely arranged along each side of the branches in slightly alternate order.

Specimens when dried lose their brilliant colouring (which is due to the presence of the animal pulp), and become black, sometimes with a tinge of red, and varnished.

The capsules are produced in immense profusion, often forming rows along the upperside of almost every pinna, and giving the zoophyte much the appearance of a miniature tree heavily laden with fruit. The female gonotheca, which is three times as large as the male, presents a structure analogous to that which has been described in several of the preceding species. It is lobate, and the segments, which are closely adherent at first, separate as the embryos reach maturity.

This is unquestionably one of the finest of the British *Sertulariidae*. We owe the first description of it to Pallas, who, in his 'Elenchus,' has characterized it with the minute accuracy that distinguished him.

Hab. *D. pinnata* seems to be confined to the southwestern district, occurring not uncommonly, at considerable depths, in the warm waters which bathe the shores of Cornwall and South Devon.

The Lizard (Pallas): off the Deadman, rare; a few miles west and north-west of the Eddystone, common (R. Q. C.): Coast of Devon (Mrs. Griffiths): Polperro, in 40 fathoms, 10 or 12 miles from shore (Laughlin). I have received many specimens from this part of the Cornish coast.

[In Mr. Busk's collection there is a specimen with the male capsules from Sydney, and one with the female from South Africa.]

7. *D. ALATA*, Hincks.

"Notes on British Zoophytes," Ann. & Mag. N. H. for February 1855, (ser. 2)
xv. 127, pl. ii.

Plate XLVIII. fig. 2.

ZOOPHYTE *blackish brown, highly varnished*; STEM *straight, rather thick, pinnate*; *pinnæ* *alternate, approximate, long, not constricted below the calyces, keeled along one side, and attenuated towards the base*; HYDROTHECÆ *elongate, adherent for about two-thirds of their length, the upper part suddenly divergent, wide, rounded below, concave above, aperture oblong, the outer margin everted*; GONOTHECÆ (male) *very small, tapering towards the base, subquadrangular above, with a muero, which bends inwards at each corner*; (female) *unknown*.

Height from 3 to 5 inches.

THIS species is closely allied to the *Sertularia mutulata*, a native of Torres Straits, described by Busk in 'The Voyage of the Rattlesnake.' The only form of gonotheca hitherto found on it is characteristic of the male sex throughout this genus. The hydrothecæ are minute; the free portion is abruptly divergent, and stands out like a bracket from the stem.

The shoots of *D. alata* are regularly pinnate, and the pinnæ are almost always simple. They are not constricted below each pair of calyces, as in most of the other members of the genus, but of uniform thickness through a great portion of their length, becoming slightly attenuated towards the base. A prominent keel runs down the centre of each pinna on one of its aspects and of the main stem. The colour of *D. alata* when dried is very dark, and the surface highly polished.

Hab. Shetland (Barlee): one mile north of Whalsey Lighthouse, Shetland, in 40 fathoms, rare; Hebrides (A. M. N.): Falmouth (Cocks): Cornish coast (C. W. P.).

Genus SERTULARIA, *Linnæus* (in part).

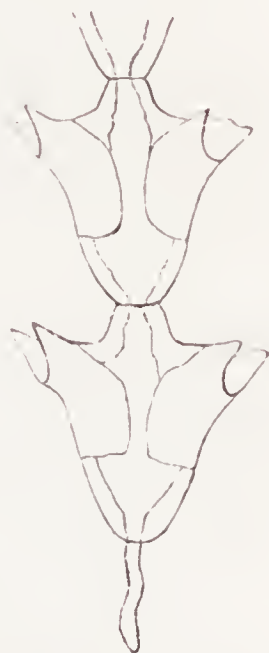
DYNAMENA, Lamouroux (in part).

AMPHISBETIA, Agassiz (for *S. operculata*).

GENERIC CHARACTER.—Zoophyte plant-like; stems more or less branching, jointed, rooted by a creeping stolon; hydrothecæ biserial, opposite, or alternate, without external operculum; gonothecæ scattered, with a simple orifice, and without an internal marsupium.

THE genus *Dynamena* was constituted by Lamouroux for the *Sertulariæ* which have the calyces opposite and in distinct pairs (Woodcut, fig. 32). Of this group one section is now referred to *Diphasia*; and I can see no valid reason for separating the remaining species from those with alternate and subalternate calyces. The character relied upon by Lamouroux as diagnostic is a very shadowy one. In such a species as *Sertularia filicula*, the hydrothecæ are commonly opposite, but they are also in many cases subalternate. On some shoots they occur regularly in pairs, and usually with a joint between each pair, as in *S. pumila*; on others they alternate slightly, and as many as six are borne on an internode. If the genus *Dynamena* were adopted, *S. filicula* must be referred to it*, and would thus be separated from *S. abietina*, to which it is clearly most closely related. It is impossible to draw a boundary line satisfactorily; and

Fig. 32.



* So Kirchenpauer places it, in a recent paper (1864), in which he has argued for the retention of Lamouroux's genus.

I therefore blend the two groups under the old Linnæan name.

Without the examination of a much larger number of foreign species, the genera of this family cannot be defined with certainty and precision; and the present grouping must be accepted as, to some extent, provisional.

Sertularia is a cosmopolitan genus, and a large number of species have been described.

With opposite calyces [*Dynamena*, Lamx.].

1. *S. PUMILA*, Linnæus.

"SEA-OAK CORALLINE." *Ellis*. Corall. 9, pl. v. figs. a, A.

SERTULARIA PUMILA, *Linn.* Syst. 1306; *Pallas*, Elench. 130; *Esper*, Pflanz. Sert. t. x. figs. 1, 2; *Lamk.* An. s. Vert. (2nd ed.) ii. 145; *Lister*, Phil. Trans. 1834, 371, pl. viii. fig. 3; *Johnst.* B. Z. 66, pl. xi. figs. 3, 4.

DYNAMENA PUMILA, *Lamx.* Bulletin Soc. Philomatique, 1812, iii. 184; Cor. flex. 179; *Flem.* Brit. An. 544; *Agassiz*, N. H. U. S. iv 355.

SERTOLARA PICCINA, *D. Chiaje*, An. s. Vert. Nap. iv. 142.

Plate LIII. fig. 1.

SHOOTS crowded on the creeping stolon; STEM *straight or gently curved from base to tip*, simple or ramified; branches opposite, and in luxuriant specimens themselves branched; both stem and branches divided by joints into short internodes, each of which, with its pair of calyces, forms a V-shaped figure; HYDROTHECÆ opposite, shortly tubular, free above for about a third of their length, narrowed towards the aperture, which is bent outwards and more or less cleft and mucronated; GONOTHECÆ (female) irregularly ovate, subsessile, with a tubular rim; (male) more slender and regularly oval.

S. PUMILA, the commonest of our littoral zoophytes, covers the fronds and stems of the various larger *Fuci* with dense miniature forests, and occurs on all parts of the coast. It

is usually of very humble size, not rising to a greater height than half an inch. In favourable situations, however, it attains a more luxuriant growth, sending up shoots of twice or three times the height, which are variously branched. Agassiz says that the specimens obtained near low-water mark are commonly "the most luxuriant, and more or less branching, while those at higher levels are quite simple."

S. pumila is of a dusky horn-colour and somewhat close texture. The polypite, which is long, slender, and graceful, has about 16 tentacles. The capsules are produced abundantly both on the main stems and branches, and often occur in continuous rows of considerable length. The female contains a single sporosae, whence the ova, which are very numerous*, are discharged into an external marsupium, protected by a gelatinous investment, in which they complete their development.

The breeding-season, according to Agassiz, extends from May to September.

Judging from the figures given by this author, there is but little difference between the male and female gonothecæ in shape, the former being somewhat slighter and more regularly oval. *S. pumila* is one of the phosphorescent species. If a frond of *Fucus* on which it is growing "receive a smart stroke in the dark, the whole coralline is most beautifully illuminated, every denticle seeming to be on fire"†.

Hab. Between tide-marks, chiefly on the larger *Fuci*, generally distributed. This zoophyte is met with on the most barren shores.

[Greenland (Fabricius): Lofoten and Finmark, common on *Fucus vesiculosus*, *F. nodosus*, and *F. serratus*, to the

* "Ovarium ovis plenissimum."—*Pallas*.

† Stewart, Elem. Nat. Hist. ii. 441. quoted in Johnston's Brit. Zooph.

North Cape (Sars): Straits of Belle Isle, abundant between tide-marks (A. S. Packard, jun.): Nova Scotia (Dawson): Grand Manan (*teste* A. Agassiz): Massachusetts Bay (Agassiz): Coast of Belgium (Van Ben.): common at Naples, from between tide-marks to 1 or 2 fathoms depth, where it often grows on *Caulinia oceanica*; the calyces longer and slenderer below than in the northern form (Sars), ? *S. gracilis*: La Charente inférieure, very common (Beltremieux): Mossel Bay, South Africa (Krauss).]

2. *S. GRACILIS*, Hassall.

SERTULARIA PUMILA, var., *Johnst.* B. Z. 67: var. β , *F. W. L. Thomas* in *Johnst.* B. Z. 469.

„ GRACILIS, *Hassall*, MS.

Plate LIII. fig. 2.

STEM *extremely delicate and transparent, filiform, simple, the internodes long, slender, and tapering, often twisted towards the base*; HYDROTHECÆ opposite, tubular, the upper half free and divergent, narrowed towards the aperture, which is small and produced into two opposite mucronated points, between which on one side the rim has a slightly angular projection; GONOTHECÆ ovate, smooth, *with a very short tubular neck, slightly marginate*.

Height about $\frac{1}{4}$ inch.

THIS species is only about half the size of its ally, *S. pumila*, and much more delicate in all its parts; it is also light-coloured and perfectly transparent. The internodes are elongate and slender, and taper off decidedly below, where there is generally a twist or fold. There is little difference in the calyces, except in size. A larger proportion of the length is usually free in *gracilis* than in *pumila*; but this is a variable character.

The capsule has a much narrower neck, and is less de-

cidedly rimmed, than in the preceding species. *S. gracilis* has a wider range than *S. pumila*, and is not an exclusively littoral form.

Hab. Brighton, on algæ (Hassall): Norfolk and Cornwall ("delicate var. of *pumila*") (C. W. P.): Swanage Bay, Dorset, abundant on *H. falcata* &c.; Lulworth, on stone; Ilfracombe (T. H.): Durham coast; Shetland (A. M. N.).

3. *S. OPERCULATA*, Linnæus.

"SEA-HAIR," *Ellis*, Corall. 8, t. iii. figs. b, B.

SERTULARIA OPERCULATA, *Linn.* Syst. 1307; *Esper*, Pflanz. Sert. t. iv. figs. 1, 2;
Lamk. An. s. V. (2nd ed.) ii. 144; *Johnst.* B. Z. 77. pl. xiv.
 figs. 2, 2.

„ USNEOIDES, *Pall.* Elench. 132.

DYNAMENA OPERCULATA, *Lamx.* Cor. flex. 176.

„ PULCHELLA, *D'Orbigny*.

AMPHISBETIA OPERCULATA, *Agassiz*, N. H. U. S. iv. 355.

Plate LIV.

SHOOTS *long, very slender*, filiform, *slightly flexuous, branched*; the branches alternate, dichotomous, often much ramified, erect; HYDROTHECÆ *opposite, small, somewhat obconic, the aperture sloping inwards towards the stem, its outer angle produced into a very fine and sharp point*, which is slightly incurved, *and with a minute denticulation on each side*; GONOTHECÆ obovate, smooth, with a plain circular aperture.

ELLIS's name for this species, "*the Sea-hair Coralline*," is sufficiently expressive of its slender, wavy habit. It grows in tufts, several inches high, many shoots rising together and giving off long, ramified branches, so as to form very large tangled masses. The branches are dichotomous and decidedly erect, and in each axil there is an inconspicuous calycle. The hydrothecæ are minute, and with their acute projecting points give a decidedly serrulate appearance to the stems and branches. Of the lateral

denticles, one is often absent or nearly obsolete, whilst the other is developed to a length equalling that of the principal mucro, which thus appears bifid.

The capsules, which are large, elongate, subsessile, ovate above and tapering off below, are irregularly and profusely distributed. They are furnished with a circular lid, that opens as the contents are matured, and remains attached by a portion of its margin, which acts as a hinge. They bear a close resemblance, as Ellis has observed, to the elegant seed-vessels of some of the mosses.

S. operculata is often prettily festooned by tufts of *Crisia eburnea*, and studded with the small, silvery patches of *Cellepora Hassallii*. It is sometimes tinged with red.

Hab. On *Fuci*, at and a little beyond low-water mark; generally distributed. It has a special liking for *Laminaria digitata*, the stems of which it often clothes with a dense, tangled thicket.

[The species has a wide range. Belgium (Van Ben.): La Charente inférieure, Bay of Biscay, pretty common (Beltremieux): South Africa (Busk): Patagonia; the Falkland Islands; the Auckland Islands; Australia; New Zealand; Kerguelen's Land.]

4. *S. FILICULA*, Ellis and Solander.

SERTULARIA FILICULA or FERN CORALLINE, *Ell. & Soland.* Zooph. 57, pl. vi. figs. c, C; *Lamk.* An. s. Vert. (2nd ed.) 146; *Lamx.* Cor. flex. 188; *Johnston*, B. Z. 76, pl. xiv. fig. 1.
 „ ABJETINA β , *Pall.* Elench. 134.
 DYNAMENA FILICULA, *Flem.* Br. An. 544.

Plate LIII. fig. 3.

ZOOPHYTE composed of long, irregularly branched, luxuriant shoots; STEMS pinnate, slender, flexible, bent at short intervals into alternate angles; pinnae crowded, springing

from every bend, short and simple, or much elongated and composite; HYDROTHECÆ *minute*, opposite or sub-alternate, *flask-shaped*, the aperture oblique and facing towards the stem, with a plain rim,—a single calycle standing erect in every axil; GONOTHECÆ pear-shaped, with a short, tubular aperture.

S. FILICULA is of delicate, wavy habit and a somewhat bright straw-colour, and is one of the prettiest of its tribe. It is generally luxuriant in growth, and presents a complex ramification. It is cast on shore in large, tangled masses, and may be known at once by its zigzag stems, its peculiar colour, and its exquisite delicacy. The flask-shaped calyces, too, with the bent apertures, one of which stands erect in each axil, afford a good distinctive mark.

Amongst the spoils of the shore, there are few things prettier than this zoophyte, and, familiar as it is, I never cease to admire with fresh zest its light and elegant tracery, its pleasant tone of colour, and the intricate luxuriance of its wavy stems and branches. *S. abietina* must be considered its nearest of kin, but the expression of the two species is totally different; the latter is coarse and clumsy as compared with its graceful ally.

The reproductive capsules are rarely met with.

Hab. *S. filicula* must be accounted one of the more local species, though it ranges from the north of Scotland to Cornwall. In the south-west district it must be very rare. Mr. Couch includes it in his 'Cornish Fauna;' but I have never met with it amongst the large quantities of trawl-refuse from Brixham and Plymouth which I have examined from time to time, nor has it occurred to me in the course of a lengthened and careful examination of the Devon and Cornish coasts. It is common near Liverpool and along the north eastern coast (Scarborough, Filey, &c.). Mr. Peach finds it "rather plentiful" at Peterhead, and

less so at Wick. Oban, in from 15–20 fath. (T. H.): Norfolk and Suffolk (C. W. P.): Ireland (W. T.).

[Grand Manan, Bay of Fundy, in 20 fath., on shelly bottoms (Stimpson): Labrador (A. S. Paekard, jun.).]

With alternate calyces.

5. *S. ABIETINA*, Linnæus.

“SEA-FIR,” *Ellis*, Corall. 4, pl. i. figs. b, B.

SERTULARIA ABIETINA, *Linn.* Syst. 1307; *Pall.* Elench. 133; *Esper*, Pflanz.

Sert. t. 1. figs. 1, 2; *Lamk.* An. s. V. (2nd ed.) ii. 141; *Lamx.*

Cor. flex. 189; *Johnston*, B. Z. 75, pl. xiii. fig. 1.

DYNAMENA ABIETINA, *Flem.* Br. An. 543.

LA SERTULAIRE SAPINETTE, *Blainv.* Actinol. 480, pl. 83. fig. 6.

SERTULARIA ABIETINULA, *Dalyell*, Anim. Scotl. i. 157, pl. xxv. figs. 6–13.

Plate LV.

STEMS *thick, slightly flexuous, regularly pinnate*; branches alternate, approximate, equidistant, simple or variously ramified; HYDROTHECÆ *comparatively large, crowded, subalternate, swollen below, narrowed above into a short neck, which is free and everted*, with a plain, oblique aperture; GONOTHECÆ subsessile, ovate, smooth, with an even, shortly tubulous mouth.

S. ABIETINA sometimes attains a height of a foot, and in luxuriant specimens is much and irregularly branched. In this state it is one of the handsomest of the British *Sertulariæ*. It is robust in habit and of a yellowish horn-colour: the shoots are gregarious and closely packed together; from a fragment of shell about $\frac{3}{4}$ of an inch in length by $\frac{1}{2}$ an inch in width, I have seen as many as twenty springing. In its young state it is simply pinnate; but mature and well-developed specimens exhibit a very luxuriant and striking ramification. The main stem, through a large part of its course, is set with simple pinnæ, which

vary much in length, becoming gradually shorter towards the apex. But every here and there branches are given off of much larger size, which are themselves pinnate, or even bi- and tripinnate,—copies, in fact, of the principal shoot. These branches often curiously imitate the growth of the parent stock, one or two only of their pinnæ attaining an exaggerated size and exhibiting a composite form. Sometimes a very large proportion of the pinnæ on the main stem are much elongated, continuing simple for about a third of their length, and then becoming pinnate for the remaining two-thirds. In this way very elegant specimens are formed, which may remind us of the proliferous fronds of some species of fern.

The capsules are produced in rows along the upperside of the pinnæ, and, it would seem, principally in the winter and early spring. The ova are developed into planules within an external marsupium, such as we find in *Sertularella polyzonias* and other species. The embryos are of a bright yellow colour.

The polypites, which project but little from the calyces, have 26 (or more) short tentacles.

Hab. On shells, stones, &c. from deep water, very common; generally distributed.

Amongst the refuse of the Brixham trawl-boats this species occurs in immense quantity. The nets come up laden with it and its allies *S. argentea* and *H. falcata*,—a glorious sight to the naturalist. The trawlers carry on their work chiefly in about 30 fathoms, and at this depth whole tracts of the sea-bottom must be clothed with a luxuriant growth of these elegant corallines. Mr. Peach informs me that at Durness, in Sutherland, *S. abietina* is often thrown ashore, with a *very* small admixture of other rejectamenta, by cart-loads, and is used as manure by the Highlanders.

We shall feel no surprise at the quantity in which this zoophyte occurs, when we remember that, besides the rapid and prolific development of new shoots from the creeping stolon, the planulæ are produced in immense numbers. At certain seasons the reproductive capsules cover the pinnæ in almost continuous rows, each of them containing, according to Sir John Dalyell, a brood of six or seven embryos. A finely grown specimen will bear some 500 pinnæ, and if only a fourth of them should produce capsules, and no more than six should occur on each of the 125, we should have at the lowest computation 4500 planulæ as the offspring of a single shoot, and 90,000 of such a cluster of shoots as I have described above. In the case of *S. argentea* the capsules are much more numerous, and we may fairly reckon the produce of a shoot at 15,000 embryos.

[Belgium (Van Ben.): La Charente inférieure, common (Beltremieux): North Cape, abundant, where there is a strong stream (Sars): Greenland (Fabricius): Mingan Islands, Gulf of St. Lawrence, and Labrador (A. S. Packard, jun.): St. George's Bank, Newfoundland (Stimpson): Mediterranean (*teste* Pallas).]

6. *S. ARGENTEA*, Ellis and Solander.

"SQUIRREL'S TAIL," *Ellis*, Corall. 6, pl. ii. figs. c, C.

SERTULARIA CUPRESSINA β, *Linn.* Syst. 1308.

„ *CUPRESSINA* (in part), *Pallas*, Elench. 142; *Esper*, Pflanz. Sert. t. iii. figs. 1, 2.

„ *ARGENTEA*, *Ellis & Soland.* Zooph. 38; *Esper*, Pflanz. Sert. t. xxvii. figs. 1, 2; *Lamk.* An. s. V. (2nd ed.) ii. 143; *Lamx.* Cor. flex. 192; *Johnst.* B. Z. 79, pl. xv. and pl. xiv. figs. 3, 3; *Agassiz*, N. H. U. S. iv. 356.

„ *FASTIGIATA*, *Fabricius*, Faun. Greenlandica, 458.

DYNAMENA ARGENTEA, *Flem.* Br. An. 544.

Plate LVI.

SHOOTS *gregarious*, *bushy*, somewhat blunt at the top;

STEMS *slightly waved*, of a dark horn-colour, *subspirally branched*; branches *alternate*, approximate, *two to each internode*, panicked, *dichotomously divided and subdivided*, so as to form somewhat broad fan-shaped offshoots, springing from different sides of the stem, in such a manner that four or five constitute a whorl; HYDROTHECÆ subalternate, *short, urceolate, narrowed towards the upper part, which is free and divergent, and produced into an acute point at the outer side*, aperture small and oblique; GONOTHECÆ broad at the top, attenuated downwards, with two spines above, or sometimes only one, and a slightly raised, circular aperture.

ELLIS's expressive name for this species, "*the Squirrel's tail*," gives a better idea of its general aspect than any technical description. The stems are thickly clothed with branches to the very bottom; but for some distance below they are small, and they also diminish towards the apex, the intermediate region being occupied by panicles of about equal size, so arranged as to cover the stem completely and produce the rotund and bushy appearance which is characteristic of the species. The branches divide and subdivide dichotomously; and at certain seasons the pinules thus formed bear the capsules, profusely, in rows.

In its young state *S. argentea* is simply pinnate, and the pinnæ all lie in the same plane; but the branches soon begin to divide and assume the corkscrew arrangement.

The shoots attain the height of a foot or more, and are occasionally bifid; they grow in dense clusters.

Hab. On shells, stones, &c. chiefly from deep water; generally distributed. One of the principal elements of the trawl-refuse on the south-west coast. *S. argentea* also occurs at times between tide-marks, but of small size.

[Ostend (Van Ben.): mouth of the Elbe (Kirchenpauer): Greenland (Fabr. and Möreh): North Cape in 30-50 fath.

(Sars): Southern Labrador, Caribou Island, in 8 fath., not common (A. S. Packard, jun.): Nova Scotia (Dawson): Grand Manan, common in 4–6 fathoms, attached to stones (Stimpson): Massachusetts Bay (Agassiz): South Africa (Busk).]

7. *S. CUPRESSINA*, Linnæus.

“SEA-CYPRESS,” *Ellis*, Corall. 7, pl. iii. figs. *a*, *A*.

SERTULARIA CUPRESSINA, *Linn.* Syst. 1308; (in part) *Pallas*, Elench. 142; *Lamk.* An. s. V. (2nd ed.) ii. 144; *Lamx.* Cor. flex. 192; *Johnst.* B. Z. 80, pl. xvi.

DYNAMENA CUPRESSINA, *Flem.* Br. An. 543.

SERTULARIA ARGENTEA, *Dalyell*, An. Scotl. i. 189, pl. xxxvii.

Plate LVII.

SHOOTS *long and slender, tapering off very gradually towards the apex, which is much produced*; STEMS *stout and straight*, branched; branches *alternate, fan-shaped, narrow, rather distant*, somewhat spirally arranged, dichotomously divided, *the pinnules long and few in number*; HYDROTHECÆ *subalternate, tubular, pellucid, adherent through most of their length, and scarcely divergent above, aperture wide, bilabiate, rising into a point on each side*; GONOTHECÆ *clongate, tapering below, with a sharp spine above at each side, or sometimes at one only, and a central aperture slightly raised and marginate*.

THE difference in habit between this and the preceding species is so strongly marked, that each of them may be recognized at a glance. Pallas, indeed, regarded them as identical, but he seems to have formed a very imperfect conception of the sum total of the distinctive characters. Dr. Johnston confesses himself doubtful; but Ellis seized the main points of difference with characteristic quickness, and saw their true value. His name for the present species,

“*the Sea-cypress*,” is very expressive of the peculiarities in its mode of growth and the gracefulness of its habit.

S. cupressina is much larger than its ally, with a thicker main stem and longer and much narrower branches, which are less frequently subdivided and less crowded together. They are gracefully arched or drooping, and of a delicate pearly whiteness, offering a striking contrast to the stout and deep-coloured and very conspicuous stem from which they spring. The branches of *S. argentea*, on the contrary, are broad, compact, rigid, and dark-coloured, forming a dense clothing, and giving a bushy appearance to the shoot. Another salient feature of *S. cupressina* is its much produced, spire-like apex. The branches begin to decrease in size at a considerable distance below the top, and from this point the shoot rapidly tapers away, often running out into a bare and branchless extremity. The calyces of the two species are also sufficiently distinct in form. Those of the *cupressina* are appressed, tubular, not much narrowed or divergent above, with a bilabiate mouth; while those of *argentea* are shorter, swollen below, tapering upwards, with the aperture bent, sharply pointed at one side, and oblique.

There are commonly six calyces to an internode in this species; but the number varies.

The polypites have about 20 tentacles, are long and slender, and extend very far beyond the orifice of the calyces.

The capsules, which when mature are crowned by their large marsupial sacs, are produced in rows along the upper-side of the pinnules, that seem to bend beneath their load. They contain about six planules.

Hab. This species seems to be less abundant than the preceding, though very widely distributed in deep water. South Devon and Cornwall (T. H.): Dorset (Forbes): very

common along the Yorkshire, Durham, and Northumberland coasts; of large size (2 feet long) at Peterhead and Wick; Norfolk (C. W. P.): in the Bristol Channel (A. M. N.): various points on the Irish coast.

[Ostend, very abundant, not far from the shore (Van Ben.): mouth of the Elbe, 2 feet in length (Kirchenpauer): La Charente inférieure, pretty common (Beltrémieux): Henley Harbour, Labrador, in 7 fath. (A. S. Packard, jun.): Massachusetts Bay (Agassiz).]

8. *S. FUSCA*, Johnston.

SERTULARIA NIGRA, Jameson, Wern. Mem. i. 565; *Johnst. B. Z.* (1st ed.) 128.

DYNAMENA NIGRA, *Flem. Br. An.* 545.

SERTULARIA FUSCA, *Johnst. B. Z.* (2nd ed.) 70; woodcuts, 57. fig. 6, 69. fig. 10 c, 70. fig. 11.

NIGELLASTRUM FUSCUM, *Gray. Cat. Br. Mus. Radiata*, 75.

DIPHASIA FUSCA, *Agass. N. H. U. S.* iv. 355.

Plate L. fig. 2.

SHOOTS *rigid, pinnate, lanceolate*, very sparingly branched, *of a blackish-brown colour, highly varnished*; STEM rather stout, lined longitudinally, jointed at distant intervals, with a row of alternate calyces on each side; pinnae alternate, several springing from each internode of the stem, simple, attenuated at the base; HYDROTHECÆ *closely set, and bent alternately to opposite sides, so as to give a quadrangular appearance to the pinna, very small, adnate, with a wide oblong mouth*; GONOTHECÆ pear-shaped, subpedicellate, smooth, borne on the upperside of the pinnae.

Height of well-grown specimens about 3 inches.

THE calyces in this species are truly biserial, but they bend alternately in opposite directions, forming a zigzag line, and have much the appearance of being arranged in four rows. They are crowded and completely adnate.

Hab. On stones &c. from deep water, rare; this is an exclusively northern form. Coast of Aberdeenshire (R. Brown): Northumberland, at Dunstanborough (R. Embleton): Cullerecoat, and from the five-men boats (J. A.): Whitburn, Durham (Miss M. Dale): off Holy Island (Newcastle Dredging-Committee): Stonehaven (Lady Keith Murray): off Staples in 35 fath., and off Buehanness (Lieut. Thomas): Peterhead, very fine, but not common (C. W. P.): Scarborough (W. B.): Filey (T. H.).

Genus HYDRALLMANIA*, *Hincks*.

Der. Named in honour of Prof. Allman.

GENERIC CHARACTER.—*Zoophyte plant-like; stem bearing plumous branches, jointed, rooted by a filiform stolon; hydrothecæ unilateral, arranged in distinct companies, each of which occupies an internode; gonothecæ scattered, with a simple, inoperculate aperture.*

H. FALCATA, the type of this genus, was referred to *Plumularia* by Johnston, on account of the unilateral arrangement of the calyces; but its affinities are with the Sertulariidae, and not with the Plumulariidae: from the latter group it is separated by the absence of nematophores.

H. FALCATA, Linnæus.

"SICKLE CORALLINE," *Ellis*, Corall. 12, pl. vii. figs. *a*, A, and pl. xxxviii. fig. 6.

SERTULARIA FALCATA, *Linn.* Syst. 1309; *Pall.* Elench. 144; *Esper*, Pflanz.

Sert. t. ii. figs. 1, 2.

AGLAOPHENIA FALCATA, *Lamx.* Cor. flex. 174.

* I have adopted this form for the generic name, simply because *Allmania* has been already appropriated to a genus of plants, in honour of another naturalist.

PLUMULARIA FALCATA, *Lamk.* An. s. V. (2nd ed.) ii. 160; *Johnst.* B. Z. 90, pl. xxi. figs. 1, 2; *Dalyell*, An. Scotl. i. 176, pl. xxxiii.

PENNARIA FALCATA, *Oken*, *Lehrb.* Nat. 94.

Plate LVIII.

STEMS slender, flexuous, spirally twisted, destitute of calyces; branches alternate, rather distant, regularly pinnate and plumose, given off above each joint,—pinnæ alternate, jointed; HYDROTHECÆ tubulous, closely appressed one to the other, ranged in pectinated rows along the pinnæ, with a break at each joint, aperture plain and obliquely truncate; GONOTHECÆ ovate, tapering below, with a slightly tubular neck.

WHEN finely grown this species attains a height of 12 inches or upwards; and the shoots are often compound, dividing, especially towards the bottom, and bearing several offshoots. The form is singularly elegant, from the spiral disposition of the spreading plume-like branches around the flexuous stem*. The pinnæ are jointed at regular intervals; and each internode bears a company of calyces, which lean, as it were, one upon another, the sharp outer angles of the oblique apertures giving a pectinated appearance to the rows; they occur on the branches as well as the pinnæ, but are not present on the main stem. The polypites are minute and pure white.

The capsules are produced abundantly in spring, and when filled with their yellow ova or planules “resemble so many minute lemons both in shape and colour.” Their structure is simple. A single sporosac, supported on a short peduncle, fills a large portion of the cavity; and within this (in the female) a number of light-yellow ciliated embryos are matured, which escape at once through the terminal aperture without passing through any marsupial

* “A series of feathers implanted in spiral arrangement around a slender stem.”—*Sir J. Dalyell*.

stage. On fixing themselves, they assume the usual circular form; the stem soon begins to rise in the centre of the disk, and the marginal portion is broken up into a number of rays, which, like so many root-fibres, bind the shoot to its place. These may still be traced in the adult condition.

In the young state the calyces are bent alternately in opposite directions; but there is no departure from the strictly unilateral arrangement (Plate LVIII. fig. *c*).

When dried, the branches of *H. falcata* become recurved, and assume the *sickle-like* appearance from which the specific name is derived.

Hab. On shells and stones, in the coralline zone, universally distributed.

[Ostend, extremely common (Van Ben.): Mingan Island, Gulf of St. Lawrence (*teste* A. S. Packard, jun.): Grand Manan; taken often in 35 fath. on the Hake-ground (Stimpson): Massachusetts Bay (Agass.): South Africa (Busk).]

Genus THUIARIA, Fleming.

Der. from *θύα*, a cedar.

GENERIC CHARACTER.—*Zoophyte plant-like; stem branching, jointed, rooted by a filiform stolon; hydrothecæ biserial, imbedded in the substance of the stem and branches.*

THUIARIA is most closely allied to *Sertularia*; but the appression and partial immersion of the calyces give it a peculiar and very distinctive aspect. Few species are known.

1. *T. THUJA*, Linnæus.

“BOTTLE-BRUSH CORALLINE,” *Ellis*, Corall. 10, pl. v. figs. *b*, B.

SERTULARIA THUJA, *Linn.* Syst. 1308; *Pallas*, Elench. 140; *Esper*, Pflanz.

Sert. t. xxii. figs. 1–3; *Lamx.* Cor. flex. 193.

CELLARIA THUJA, *Lamk.* An. s. Vert. (2nd ed.) ii. 185.

NIGELLASTRUM THUJA, *Oken*, *Lehrb. Nat.* 93.

THUIARIA THUJA, *Flem. Brit. An.* 545; *Johnst. Br. Z.* 83, pl. xvii. & xviii.
figs. 1, 2.

BISERIARIA THUJA, *Blainv. Actinol.* 482, pl. lxxxi. fig. 3.

Plate LIX.

STEM filiform, *rigid, zigzag* (the spaces between the angles very short), annulated towards the base, and obliquely jointed for some way above it, *black or dark horn-colour and glossy, clothed with branches towards the top, but in the adult state denuded of them through the greater portion of its length; branches alternate, somewhat spirally arranged (four forming a whorl), jointed to small projections (which remain after they have fallen, and give a knotted appearance to the stem), divided and subdivided dichotomously*; branchlets rounded and tapering towards the extremity; HYDROTHECÆ subalternate, smooth, approximate, broadly ovate below, tapering upwards,—the aperture transversely oblong, somewhat arched above; GONOTHECÆ produced at the base of the calyces, subpedicellate, pear-shaped, smooth, with a circular, slightly margined and operculate aperture.

THE fishermen's name for this species, "the Bottle-brush," which has been preserved by Ellis, gives an admirable idea of its general appearance. The stems, which sometimes attain the height of a foot, are bare for a great portion of their length, the lower branches dying off as growth proceeds, while the upper, which remain attached, form a cylindrical brush, of varying size, at the top; they are strongly annulated at the base, and spring from a dark, spreading crust, concentrically wrinkled. Both Pallas and Johnston describe the stem as being destitute of calyces and joints; but this is far from being the case. The lower portion of it is divided into segments by strongly marked oblique joints, which, however, do not extend upwards, or at least only occur occasionally and without regularity;

whilst a line of calyces winds round it spirally from top to bottom. A single joint also occurs on the branches a little above their origin; and it is at this point that they break off, leaving the basal portions, which form the knots that roughen the denuded section of the stem.

The "brush" varies in size, and is sometimes of considerable length. When fresh, it is of a fine reddish-brown colour, and contrasts well with the dark shining stem. The young is simply pinnate. The long, bare stalks of *Thuiaria thuja* offer a fine field for settlers, and are commonly occupied by a large foreign population; they are often encrusted by *Cellepora* and *Alcyonium*, and overspread by the delicate network and minute cups of the smaller Hydroida (*Lafoëa*, *Filellum*, &c.).

Hab. On shells &c. from deep water. A prevalent northern form, ranging to the North Cape. The finest specimens I have seen were from the Dogger Bank; they were remarkable for the great length both of the stem and brush. South Devon (Turton and Kingston): Cornwall, very rare; from deep water, Polperro (Couch).

[Mediterranean (*teste* Pallas): Tromsö and North Cape on shells (*Pecten Islandicus* &c.) in 30–40 fath. (Sars): Gulf of St. Lawrence (*teste* A. Agassiz): a *Thuiaria* resembling *T. thuja* is found, on the authority of Stimpson, in Behring's Straits.]

2. T. ARTICULATA, Pallas.

"SEA-SPLEENWORT OR POLYPODY," *Ellis*, Cor. 11, pl. vi.

SERTULARIA ARTICULATA, *Pallas*, Elench. 137; *Esper*, Pflanz. Sert. t. viii. figs. 1, 2.

„ LONCHITIS, *Ellis* & *Soland.* Zooph. 42.

CELLARIA LONCHITIS, *Lamk.* An. s. Vert. (2nd ed.) ii. 186.

THUIARIA ARTICULATA, *Flem. Br. An.* 545; *Johnst. B. Z.* 84, pl. xviii. figs. 3, 4.

NIGELLASTRUM ARTICULATUM, *Oken*, Lehrb. Nat. 93.

Plate LX.

SHOOTS *simple or irregularly divided*; STEM *very slightly*

waved, compressed, annulated at the bottom, pinnate above, generally naked below; *pinnæ usually simple*, sometimes much divided and subdivided dichotomously, *alternate or subalternate, attenuated at the base, approximate*; HYDROTHECÆ subalternate, closely set, broad and truncate below, becoming narrower above and projecting slightly, with a plain, circular orifice; GONOTHECÆ pear-shaped, smooth, with a round aperture at the top and an operculum.

THULARIA ARTICULATA usually attains a height of from 4 to 6 inches. A very luxuriant specimen, dredged by Mr. Hyndman off Sana Island (in forty fathoms), measured $10\frac{1}{2}$ inches; but this is quite an exceptional size. The shoots are plumous in form, and, when living, of a "pellucid amber-colour." They are commonly branched; but there is no regularity in the mode of growth. The pinnæ are usually alternate, but in some cases nearly opposite; they are articulated, as in *T. thuja*, near the base to a short projection from the stem, but are not deciduous to the same extent as in that species. A row of calyces runs up each side of the stem, two or three being placed between every pair of pinnæ.

A remarkable variety occurs in Shetland, of which I have a specimen from Mr. Norman, which has the pinnæ much slenderer than in the common form, and the calyces somewhat widely separated (Plate LX. fig. *d*). The habit, too, is diffuse, and some of the pinnæ are much ramified.

Hab. Widely distributed, but not generally abundant; on stones and shells from deep water. Cornwall, deep water (50 fath.) (Couch): Devon, not uncommon (T. H.): Scarborough (W. Bean): Northumberland (J. A.): Clyde (Forbes): Norfolk, Peterhead, and Wick (C. W. P.): Sana Island (Scotland) (Hyndman): Shetland (A. M. N.): Isle

of Man (Forbes): Dublin (Ellis): north of Ireland (W. Thompson).

Family IX.—Plumulariidæ.

HYDROTHECÆ sessile and unilateral; ZOOPHYTE furnished with nematophores (minute calyces, containing an extensile offshoot from the cœnosarc, and frequently bearing thread-cells); POLYPITES with a single wreath of filiform tentacles round a conical proboscis; gonozoids always fixed.

ANTENNULARIA, Lamarck.

Der. From *Antennula*, dimin. of *antenna*, the feeler of an insect.

NEMERTESIA, Lamouroux.

GENERIC CHARACTER.—Zoophyte plant-like; stems simple or branching, jointed, clothed with verticillate branchlets, and rooted by a mass of fibres; hydrothecæ cup-shaped; nematophores bithalamic, distributed along the stem; gonothecæ axillary, unilateral.

THE curious organs which Mr. Busk has named nematophores make their appearance in the family of the *Plumulariidæ*, and are not met with beyond it. They are present in great numbers on the members of this genus; but, as a full account of them is given in the Introduction, it is unnecessary to allude to them further in this place.

1. *A. ANTENNINA*, Linnæus.

“LOBSTER’S-HORN CORALLINE OR SEA-BEARD,” *Ellis*, Corall. 15, pl. ix. figs. *a*,
A, B.

SERTULARIA ANTENNINA, *Linn.* Syst. 1310; *Pallas*, Elench. 146; *Esper*,
Pflanz. Sert. t. xxiii. figs. 1–4.

NIGELLASTRUM ANTENNINUM, *Oken*, Lehrb. Nat. 93.

NEMERTESIA ANTENNINA, *Lamx.* Cor. flex. 163.

ANTENNULARIA INDIVISA, *Lamk.* An. s. Vert. (2nd ed.) ii. 156.

„ ANTENNINA, *Johnst.* B. Z. 86, pl. xix. figs. 1, 3.

Plate LXI.

STEMS clustered, *simple or slightly branched, elongate, erect, filiform*, and springing from a sponge-like mass of interlacing fibres; BRANCHLETS *short, incurved*, swollen at the base—a whorl on each articulation of the stem—divided by oblique joints into *internodes*, which are *alternately larger and smaller, the former bearing the calyces*; HYDROTHECÆ small, campanulate, distant, with an even rim, *always separated by two joints*; NEMATOPHORES conical cup-shaped, a pair almost immediately above each calyx, and one below it—one on the small intervening internode, and *two* (one on each side) *at the base of the branchlet*; GONOTHECÆ produced singly in the axils of the branchlets, oval, subpedicellate, with a subterminal circular aperture, looking towards the main stem.

THE long thread-like shoots of *A. antennina* grow in clusters of as many as 40 or 50, and are inserted at the base in a compact fibrous mass of considerable size, in which fragments of shell, stones, &c. are usually imbedded. The delicate chitinous threads or rootlets which compose this curious appendage grow out in whorls from the lower region of the stem, and represent the branchlets of the upper portion.

This species attains a height of 8 or 10 inches, and is

of a bright yellowish horn-colour when fresh. The branchlets are supported on short processes from the main stem, which are ranged in verticils, and are permanent. The pinnules themselves are commonly broken off; and specimens in this condition have much the appearance of the lobster's *antenna*, whence the name is derived.

Allman has described a curious peculiarity in the structure of the cœnosarc, which is readily observed in specimens preserved in fluid. "Instead of forming a single tube, it consists of numerous separate tubules, each with its ectoderm and endoderm. The tubules lie close upon the polypary, and leave an unoccupied space in the axis of the stem." This peculiar structure gives a lined appearance to the stems.

The female capsule contains one sporosac (occasionally two), in which a single yellow ovum is produced; and this gives rise to a planuloid embryo of large size*.

In its earliest state the branchlets of *A. antennina* are arranged alternately, and there is no tendency to the verticillate condition characteristic of the adult; in a more advanced stage they form alternate *pairs*.

This species is sometimes slightly branched, but the branching is of the simplest kind, amounting to nothing more than an occasional bifurcation of the long slender shoots.

Hab. Generally distributed in deeper water, and commonly on a sandy bottom.

[Belgium, common (Van Ben.): La Charente inférieure, pretty common (Beltremieux).]

* Sir J. Dalyell says that it is nearly one-twelfth of an inch in length.

2. *A. RAMOSA*, Lamarck.

“LOBSTER’S-HORN CORALLINE, var.,” *Ellis*, Corall. 15, 16, pl. ix. figs. *b*, *C*.

SERTULARIA ANTENNINA β , *Linn.* Syst. 1310.

NEMERTESIA RAMOSA, *Lamx.* Cor. flex. 164.

ANTENNULARIA RAMOSA, *Lamk.* An. s. Vert. (2nd ed.) ii. 156; *Hassall*, Ann. & Mag. N. H. vi. 168, pl. v. figs. 1, 2; *Johnst.* B. Z. 88, pl. xx.

SERTULARIA SETICORNIS, *Hogg’s* Stockton, 33.

ANTENNULARIA ARBORESCENS, *Hassall*, Ann. N. N. xi. 111.

Plate LXII.

SHOOTS *rising by a single trunk, which at a certain height divides and subdivides irregularly*, and springing from a dense mass of root-fibres; STEMS *thick*; BRANCHLETS *long, tapering, slightly curved outwards*, much swollen at the base, jointed, *the internodes straight and of equal length, arranged in whorls, which are very closely set, so that the stems are densely clothed* with the hair-like ramules; HYDROTHECÆ small, campanulate, distinct, *separated by a single joint*; NEMATOPHORES the same in number and arrangement as in the preceding species, except that on the basal portion of the branchlets there are sometimes as many as six, and one is present on the main stem, a little above their origin; GONOTHECÆ pear-shaped, smooth, single, with a subterminal aperture, facing towards the stem.

It is not a little strange that there should have been so much doubt and diversity of opinion amongst authors respecting the claims of this handsome form to specific rank. Even the “lyncean Ellis” and Pallas were at fault; and Dr. Johnston, though he separates it from *A. antennina* in his second edition, seems to have been thoroughly perplexed, and never to have arrived at a clear conviction on the subject. Hassall, who rightly asserted the distinctness

of *A. ramosa*, unwittingly increased the confusion by basing his diagnosis mainly on a character which has no real existence !

The distinctive points, however, are sufficiently marked and are to be found not only in the ramification and general habit, but also in the minute structure.

Mr. Alder was the first to indicate, and with his usual accuracy, the differences in detail between the two species; but even he has omitted one or two characters of considerable importance. In general aspect *A. ramosa* and *A. antennina* are strikingly dissimilar, the luxuriantly branched and tree-like shoots of the former offering a decided contrast to the long, simple, and thread-like stems of the latter. But the difference is not due only to the ramification. The stems of *A. ramosa* are much thicker than those of its ally, and the whorls much more closely set upon them; they are therefore more densely clothed with the branchlets; and as these are longer than in *A. antennina*, and more numerous in each verticil, they give a peculiarly stout and rotund appearance to the shoots.

The ramuli are long and somewhat recurved, and have none of the sickle-like shape which is characteristic of those of the preceding species; they are made up of straight internodes of about equal length, each of which bears a calycle. The short intervening internodes, supporting a nematophore only, which occur in *A. antennina*, are wanting; in *A. ramosa* the corresponding nematophore occurs on the internode that bears the hydrotheca.

Hab. Generally distributed; as abundant as the preceding. At Peterhead and Wick, Mr. Peach informs me, it is commoner than *A. antennina*; and so it is, according to Macgillivray, at Aberdeen. It is very fine and abundant in Shetland.

[South Africa (Busk).]

Genus AGLAOPHENIA, *Lamouroux* (in part).

PLUMULARIA, Lamarck (in part).

AGLAOPHENIA, M'Craday.

GENERIC CHARACTER.—*Shoots plumose, simple or branched, rooted by a filiform stolon; hydrothecæ cup-shaped or tubulous; nematophores only developed in connexion with the hydrotheca, two lateral and one anterior; gonothecæ collected in corbulæ, or borne singly near the base of the pinnae.*

FORBES long ago suggested the dismemberment of the Lamarckian genus *Plumularia*. Johnston, taking the hint, sketched a rearrangement in a note at the close of his *Hydroida*, which very accurately represents the natural affinities, though he overlooked the character which has the greatest value for the purposes of diagnosis. More recently, Busk has proposed to divide *Plumularia* into two generic groups, characterized by the disposition of the nematophores and the presence or absence of a corbula or protective case for the reproductive capsules. Retaining the old designation for one of them, he has suggested (but not published) the name *Halicornaria* for the second.

There can be no doubt that the *Plumulariæ* (omitting *P. falcata*, Lamk.) divide themselves into two very natural groups, based on the special arrangement of the nematophores. In one section these organs are appendages of the hydrotheca only, and are disposed on a very definite and constant plan around it; in the others they are distributed generally and profusely along the stem and branches. With this cardinal distinction are associated differences of habit and aspect which give a marked *facies* to the two genera.

The *corbula*, which is a pinna modified so as to form a protective envelope for the gonothecæ, is commonly present in the former of these groups, but is by no means universal. In one section, of which *A. pennatula* is the British representative, it is altogether wanting. Where it is present, it occurs under two forms. In *A. pluma* and allied species it is a closed case; the transverse ribs or girders which constitute the framework are united by a thin chitinous expansion, and the capsules are thus enclosed in a pod-like receptacle.

In another section, to which *A. myriophyllum* and many foreign species belong, the *corbula* is open; a number of disconnected curved processes, springing from the base of the hydrothecæ, arch over the capsules and afford them a certain amount of shelter. These open corbulæ are often of great length, and are very beautiful structures. In the second group of *Plumulariæ* the gonothecæ are always scattered and unprotected.

On the whole it seems better to retain the two old names, assigning Lamouroux's to one division and Lamarck's to the other, than to introduce a new term*.

The genus *Aglaophenia* is widely distributed, and contains many very striking forms. Some of the species attain a very large size. Dana describes the East-Indian *A. angulosa* as reaching a height of 3 feet, and bearing its plumes, on an average, about half an inch apart, on opposite sides; he computes that the number of polypites on a single specimen is not less than eight millions, "all the offspring of a single germ, and produced by successive buddings."

* M'Cradly and Agassiz have adopted this course.

With closed corbulæ.

1. A. PLUMA, Linnæus.

“THE PODDED CORALLINE,” *Ellis*, Corall. 13, pl. vii. figs. *b*, B.

SERTULARIA PLUMA, *Linn. Syst.* 1309; *Pall. Elench.* 149; *Esper*, Pflanz. Sert. t. vii. figs. 1, 2; *Lister*, Phil. Trans. 1834, 369, pl. viii. fig. 2.

AGLAOPHENIA PLUMA, *Lamx. Cor. flex.* 170; *Agassiz*, N. H. U. S. iv. 358.

PLUMULARIA CRISTATA, *Lamk. An. s. Vert.* (2nd ed.) ii. 161; *Johnst. B. Z.* 92, pl. xxiii. figs. 1-3, and pl. xxiv. fig. 1.

„ PLUMA, *Flem. Brit. An.* 546.

PENNARIA PLUMA, *Oken*, Lehrb. Natur. 94.

Plate LXIII. fig. 1.

STEM recurved, smooth, dark brown; pinnæ alternate, simple, one to each internode, approximate, springing from the front of the stem; HYDROTHECÆ *cup-shaped, expanding above, aperture patulous, with a strongly denticulated and somewhat everted margin*; NEMATOPHORES *tubular, channelled, the lateral small and not projecting much; the anterior stout, adnate through great part of its length, free at the extremity, which projects but slightly*; GONOTHECÆ oviform, protected by a pod-shaped receptacle, formed by the union of a number of crested ribs, and occupying the place of a pinna. Var. β . Dichotomously branched, and of delicate habit.

I HAVE restored the original name conferred on this well-known species by Linnæus, which has been unaccountably supplanted in later English works by Lamarck's designation.

The graceful plumes rise from a flexuous, creeping fibre, which trails over the stems and branches of Fuci, and especially of *Halidrys siliquosa*, large masses of which are often profusely covered by this zoophyte. They sometimes attain a height of 3 inches or upwards, and bear as many as a dozen of the curious ribbed and crested cases (*corbulæ*)

which enclose the reproductive capsules. I have seen fine Devonshire specimens in which the plumes measured three-quarters of an inch across, and were most elegantly curved.

The pinnæ are of a lighter colour than the stem, and are set forward upon it, so that the pairs form a series of obtuse angles; and the plume is somewhat carinated below. Each pinna is slightly arched, and the shoot itself is generally recurved; so that the whole structure is bounded and pervaded by lines of beauty.

A variety (β)* occurs, of very delicate habit, in which the stem divides and subdivides dichotomously, each branch being plumose and pinnate.

Hab. On weeds, especially *Halidrys siliquosa*, and occasionally on shells, rocks, &c.; between tide-marks, and in the Laminarian zone.

A. pluma is much more at home in the south and west than in the north. We have no record of its occurrence in Shetland, nor has Mr. Peach met with it at Peterhead or Wick. Throughout the north it seems to be sparingly distributed, whilst along the south-western coasts it is extremely abundant and of great size and beauty. Between tide-marks it is of humbler growth, and is found covering the surface of the rock, or investing the roots and stems of *Laminaria*.

Westra, Orkney Islands (Lieut. Thomas): Ayrshire, often cast in after storms (D. L.): Whitburn Bay, Northumberland (a single specimen found) (J. A.): Filey, not common (T. H.): Mersey, occasionally on *Halidrys* (Dr. Collingwood): Barmouth (J. G. Jeffreys): Isle of Man (T. H.): around the coast of Ireland (W. T.): Dover (Lister): Jersey (A. M. N.): Devon and Cornwall, very

* *Var. dichotoma*, Sars, Middelhavet's Litt. Fauna, 55.

abundant; Scilly (T. H.). Var. β . Cork Bay (J. V. Thompson): Ilfracombe; South Devon (T. H.).

[Belgium, on *Fucus*, very rare (Van Ben.): La Charente inférieure, pretty common (Beltremieux): Bay of Naples, not uncommon, growing on small algæ, frequently on the stems of *Caulinia oceanica*, of small size; also from 1–2 fathoms depth; Messina, from 30–40 fathoms, of much larger size. Var. β on *Cystosira ericoides* (Sars): Mossel Bay, South Africa (Krauss).]

2. A TUBULIFERA, Hincks.

PLUMULARIA CRISTATA, var., Couch, Corn. Faun. 32; Johnst, B. Z. 94, fig. 16.

„ TUBULIFERA, Hincks, Devon. Cat. Ann. N. H. (ser. 3) viii. 256, pl. vii. figs. 1, 2.

Plate LXIII. fig. 2.

SHOOTS *tall, slender in habit*; STEM divided by oblique joints into short internodes, each of which bears a pinna; pinnæ alternate, long, approximate, springing from the anterior aspect of the stem; HYDROTHECÆ *deep cup-shaped, slender, incurved above in front, margin finely denticulate, very slightly everted*; NEMATOPHORES *tubular, with an oblong terminal aperture,—the lateral large and very prominent, forming ear-like appendages on each side; the anterior a long spine-like process, tapering downwards, free through a large part of its length, and sometimes projecting beyond the rim*; CORBULÆ long, pod-shaped, with numerous serrated ribs (7–11), which are very prominent and sometimes rise at the top into crested ridges—*furnished with an expanded spur-like process with serrated edges, springing from the base at one side*; GONOTHECÆ oval, shortly stalked, arranged in a double row along the central line.

THE plumes of this species are of a very delicate habit, and reach the height of 2 or 3 inches; they bear a strong

general resemblance to those of *A. pluma*, from which, however, they are readily distinguished on examination. The hydrothecæ of *A. tubulifera* are slender, somewhat elongate, gracefully incurved in front, with a very slightly everted margin, and are not expanded above like those of *A. pluma*, which are also broader and have a very patulous opening. The marginal denticulation is delicate, and very much finer than in the latter species, in which the rim is cut into large and prominent spines, that are much bent outwards. The lateral nematophores, which in *A. pluma* are small and inconspicuous, constitute a striking feature in the present species, and give a peculiar aspect to the pinnæ when viewed in front. The anterior nematophore in *A. pluma* is adnate throughout almost the whole of its length, the extremity only being free, and this not projecting much. In *A. tubulifera* a considerable portion of it is detached and very divergent, and it attains a much greater size, sometimes rising above the rim.

A very curious and striking character of the present species is the large spur-like process attached to the base of the corbula. This is evidently a supernumerary rib, which, instead of forming part of the protective case, is converted into a mere appendage. The marginal teeth which surround it, and also those which give the serrated appearance to the ribs of the corbula, are all nematophores.

Hab. On seaweed, zoophytes, shells, &c. in moderately deep water; not common. Off the Isle of Mull in 30 fathoms (Prof. E. Forbes): Cornwall, on *Gorgonia* &c. from deep water; Oban Bay, abundant in 15 to 20 fathoms (T. H.). Very fine and luxuriant specimens were obtained in the last locality, in some of which the plumes were bifid. Hebrides (A. M. N.).

[There is a specimen from Algoa Bay in Mr. Busk's collection.]

With open corbulæ.

3. A. MYRIOPHYLLUM, Linnæus.

- “PHEASANT’S-TAIL CORALLINE,” *Ellis*, Corall. 14, pl. viii. figs. *a*, *A*.
 SERTULARIA MYRIOPHYLLUM, *Linn.* Syst. 1309; *Pall.* Elench. 153; *Esper*,
Pflanz. Sert. t. v. figs. 1–3.
 AGLAOPHENIA MYRIOPHYLLUM, *Lamx.* Cor. flex. 168; *Agassiz*, N. H. U. S.
 iv. 358.
 PLUMULARIA MYRIOPHYLLUM, *Lamk.* An. s. Vert. (2nd ed.) ii. 159; *Johnston*,
 B. Z. 99, pl. xxiii. figs. 4, 5; *Landsborough*, Pop. Hist. B. Z.
 152, pl. ix. fig. 28.
 PENNARIA MYRIOPHYLLUM, *Oken*, Lehrb. Natur. 94.

Plate LXIV. fig. 2.

SHOOTS *clustered, tall, and “eminently plumous,”* of a yellowish colour, rising from a tuft of tangled fibres; STEM *compound, gibbous, or swelling out at intervals into oblong knobs, pinnate, simple or slightly branched*; pinnæ *alternate, set closely together, often of considerable length, springing from one of the tubes which compose the stem, and so nearly in a single line as generally to fold together and appear unilateral*; HYDROTHECÆ *rather large, deep, cylindrical, margin very slightly crenated, and rising into a single larger denticle in front*; NEMATOPHORES, *two lateral, suberect, projecting a little above the rim,—one anterior, a curved spinous process, with an orifice at the top, which embraces the lower portion of the calycle*; GONOTHECÆ *produced in pairs on modified pinnæ near the base of the hydrothecæ, sessile, smooth, “resembling a mussel-shell in shape,” protected by a number of long, curved processes denticulated on the outer edge, which arch over them and form a kind of corbula.*

THE stem of this very handsome species (the “*Palma marina*” of old Barrelier*, the “Pheasant’s-tail” of Ellis)

* 1714.

is formed of several tubes bound together, and exhibits one or two peculiarities. On the back of it, "at nearly equal distances, are formed little regular arch-like risings, which are compressed and hollowed a little in the middle." (*Ellis.*) This is a very accurate description of these curious prominences, which have been supposed to mark the stages of growth. They are formed by the occasional divergence of a portion of the tubes from the ascending line of the stem, and are, in fact, *arrested branches*. The ramification of *A. myriophyllum* is very slight and simple, seldom passing beyond a single division of the shoot, which generally takes place not far from the bottom of it. In this way a double plume is formed. The branch rises from one of the knobs, and is a continuation of the divergent fascicle of tubes, which in other cases remains a mere excrescence on the stem. Frequently too, even when the branch is not perfected, the diverticulum rises into a free spinous point above, which shows its real significance. I have seen a small and imperfect plume springing from one of the knobs on a branch, and it is possible that cases may occur of still further ramification; but the common habit of *A. myriophyllum* is undoubtedly simple.

Another peculiarity of the stem is to be found in the rows of closely set pores, with raised orifices, which occupy the furrows between the tubes and give it a punctate appearance under the lens.

The pinnæ in perfect specimens usually clothe a large proportion of the stem, a small section only towards the base being naked.

The reproductive bodies, which were first noticed by Dr. Landsborough, whose name is pleasantly associated with this species, differ from those of its British congeners in being protected by a number of detached overarched processes, and not by a closed case or *corbula*. *A. myrio-*

phyllum attains a height of from 6 to 12 inches, and in luxuriant specimens 18.

Hab. Rare, chiefly from deep water. Cornwall (not common) (C. W. P.): Brixham, Torbay (occasionally amongst the trawl-refuse) (T. H.): Plymouth Sound (Bellamy): Dartmouth (G. Busk): off Jersey (Lewes): Mersey (Dr. Collingwood): Embleton Bay, a single specimen (Dr. Embleton): Estuary of the Clyde (T. H.): Lamlash Bay (D. L.): Aberdeen (Macgillivray): Loch Fyne; Shetland (A. M. N.): Peterhead, one specimen (C. W. P.): Isle of Man (E. Forbes): Dublin, from very deep water (Ellis): Belfast Lough (M'Calla): Youghal (Miss Ball).

[The Mediterranean (Pallas): Massachusetts Bay (Agassiz): Mingan Islands, Gulf of St. Lawrence (*teste* A. Agassiz).]

Without corbulæ.

4. A. PENNATULA, Ellis and Solander.

SERTULARIA PENNATULA, *Ellis & Soland.* 56, pl. vii. figs. 1, 2.

AGLAOPHENIA PENNATULA, *Lamx.* Cor. flex. 168; *Expos. Méth.* ii. pl. vii. figs. 1, 2; *Agassiz*, N. H. U. S. iv. 358.

PLUMULARIA PENNATULA, *Lamk.* An. s. Vert. (2nd ed.) ii. 165; *Johnst.* Br. Zooph. 94, pl. xxii. figs. 1, 2.

Plate LXIII. fig. 3.

SHOOTS *plume-like*, slender, very graceful; STEM straight, *pinnate* for about two-thirds of its length, naked below, divided into short internodes, each of which bears a pair of pinnæ; pinnæ subalternate, crowded, curved, and springing from the anterior aspect of the stem; HYDROTHECÆ small, cup-shaped, aperture wide, the margin sinuated, with a minute denticle on each side,—a long incurved spine springing from the base of each calycle in front, rising considerably above the orifice and bend-

ing over it; NEMATOPHORES minute, one on each side of the calycle above, placed a little below the margin, and not projecting; GONOTHECÆ *rudely pyriform*, subpedicellate, smooth, *borne singly on the stem at the base of the pinna*.

Height from 3 to 6 inches.

THIS is a rare and beautiful species, of which Ellis might well say that it is "as remarkable for its elegance of form as its likeness to the feather of a pen." The pinnæ are placed very close to one another on the anterior surface of the stem, and have therefore a tendency to fold together and assume a second appearance.

The most remarkable point in the history of this species is the absence of the corbula, or protective case, which encloses the gonothecæ in other members of the genus. The capsules, which have not been hitherto described, are distributed along the main stem, springing singly at the base of the pinnæ, just as in other species they are produced at the origin of the ribs which gird the corbula (Woodcut, fig. 33). In this case, the fertile plume itself forms, as it were, a corbula, the pinnæ arching over the gonothecæ. I have a variety from Devonshire which measures three-quarters of an inch across, and is much less delicate and feather-like than the ordinary form.

Fig. 33.



Hab. On shells, seaweed, &c.; very rare. On the *Pinna ingens*, from deep water, off the Deadman point, very rare (Couch): obtained off the Cornish coast several times on the Corwich crab and the stems of *Laminaria digitata*; a magnificent mass from Gorran Haven; Torbay, a single specimen (C. W. P.): Swanage,

Dorset, on *Halidrys siliquosa*; Teignmouth (T. H.): near Roundstone, Galway (M'Calla): profusely investing about 6 inches of the stem of a *Laminaria digitata*, Youghal (Miss M. Ball). Miss Ball's remarkable specimen has supplied the principal cabinets in the country.

Genus PLUMULARIA, *Lamarck* (in part).

Der. *Plumula*, a little feather.

AGLAOPHENIA, *Lamouroux* (in part).

PLUMULARIA, *M'Crady*.

HALICORNARIA, *Busk*, MS.

GENERIC CHARACTER.—*Zoophyte consisting of plumous shoots, simple or branched, jointed, attached by a creeping stolon; hydrothecæ cup-shaped; nematophores distributed along the stem and branches; gonothecæ scattered or crowded together, but always unenclosed, differing in the two sexes.*

THE members of this genus are generally distinguished by great delicacy of habit, and want the dense corneous texture of the *Aglaopheniæ*. The nematophores, which present two or three distinct forms, are usually developed in great profusion, and have no special connexion with the calyces.

In some of the species the gonothecæ are massed together in great numbers, in others they are distributed singly; but they are never gathered together in companies under the protection of a *corbula*. They differ more or less in the two sexes. The polypites are commonly shaped like a dumb-bell, and of very large size in proportion to the calycle, into which they are not wholly retractile.

We know little of the geographical distribution of this genus. It has representatives in North America; one or two, at least, of our British species range to the Mediterranean, and one has been found in Van Diemen's Land. In the extreme north of Europe, both this and the preceding genus would seem to be sparingly developed, if not altogether wanting; for they are not recorded by Sars as occurring in Norway, nor do they find a place in Mörch's list of Greenland Hydroids.

1. *P. PINNATA*, Linnæus.

SERTULARIA PINNATA, *Linn. Syst.* 1312; *Ellis & Soland. Zooph.* 46.

AGLAOPHENIA PINNATA, *Lamx. Cor. flex.* 172.

PLUMULARIA PINNATA, *Lamk. An. s. Vert.* (2nd ed.) ii. 164; *Johnst. B. Z.* 95, pl. xxi. figs. 4, 5; *Agassiz, N. H. U. S.* iv. 358.

Plate LXV. fig. 1.

SHOOTS clustered, *tall, white, or of a pale horn-colour*; STEM straight, jointed irregularly; *pinnæ alternate, several on each internode*; HYDROTHECÆ *rather distant, wide, with an entire rim, separated by a single, somewhat oblique joint*; NEMATOPHORES *sessile, very minute, one below each calycle*; GONOTHECÆ forming a double row along the main stem, *rudely ovate or pear-shaped, shortly stalked, and with a number of spinous projections at the top.*

P. PINNATA sometimes attains a height of seven, and commonly of four, inches; it also occurs of much humbler growth, rising only to one and a half inch or two inches. It is distinguished from *P. setacea* by its more robust habit and larger size, as well as its minute structure. The calycles of *P. pinnata* are only separated by a single joint, those of *P. setacea* by two. Several pinnæ usually spring from each segment of the main stem;

but there is no constancy in the number; and I have seen specimens in which the internodes were short, as in *P. setacea**, and bore only one. Dr. Johnston assigned three pinnae to each internode, and relied mainly on this character as a distinctive mark of the species; but on the same shoots the number often ranges from two to five. A much safer criterion is to be found in the nematophores, which are scantily developed and exhibit a very peculiar structure. They are not pedunculated as in the other species, but consist of minute cup-shaped processes that are immediately attached to the side of the pinna, one below each calycul.

When present, the reproductive capsules afford another good specific character; they are never *axillary*, but are produced in rows along each side of the central stem. They are irregular in shape, somewhat ovate, and generally more or less spinous at the top. The male are smaller and much less numerous than the female; both sexes occur on the same stem.

Hab. On shells, stones, seaweed, &c., from low-water mark to deep water; common. It ranges from Cornwall to Shetland, and is generally distributed. The deep-water specimens are of the largest size.

2. *P. SETACEA*, Ellis.

"SEA-BRISTLES," *Ellis*, Corall. 19, pl. xi. figs. a, A.

CORALLINA SETACEA, *Ellis*, Corall. pl. xxxviii. fig. 4.

SERTULARIA PINNATA β, *Linn.* Syst. 1312.

„ *SETACEA*, *Pall.* Elench. 148.

* It must be remembered that in *P. setacea* there is *never* more than one pinna to an internode; the *rule* in the case of *P. pinnata* is that there are several.

AGLAOPHENIA SETACEA, *Lamx.* Cor. flex. 272.

PLUMULARIA SETACEA, *Lamk.* An. s. Vert. (2nd ed.) ii. 165; *Johnst.* B. Z. 97, pl. xxii. figs. 3-5 [*not* fig. 81, p. 465]; *Agassiz*, N.H. U.S. 358.

PENNARIA SETACEA, *Oken*, *Lehrb.* Nat. 94.

Plate LXVI. fig. 1.

SHOOTS *very delicate*; STEM *slightly waved* and regularly jointed; *pinnæ alternate*, one to each internode, originating immediately below the joint, *composed of longer and shorter internodes, placed alternately, the former bearing the calycles*; HYDROTHECÆ small, with an even rim, *very distant, separated by two joints*; NEMATOPHORES *elongate, two abreast behind and above the calycle, two in a line below it, one at the origin of the pinnæ, and one on each segment of the stem*; GONOTHECÆ borne in the axils of the *pinnæ*; female ampullate, smooth, produced above into a tubular neck, with a plain orifice; male linear-oblong, slender, smaller than the female, less produced above, and tapering to a fine point, with a very minute terminal aperture.

P. SETACEA varies considerably in size; it is commonly from an inch to an inch and a half in height, but sometimes attains a larger growth. A variety occurs which is much and irregularly branched, and of luxuriant habit. Its arborescent shoots are very unlike the neat little plumes of the more usual form; but the minute characters of the two are identical. This variety, which I have only received from Cornwall, I believe to be from deep water. In rock-pools, and when fringing the stems and branches of other zoophytes (it has a marked predilection for *Antennularia*), *P. setacea* is of extreme tenuity and delicacy. In other situations it is frequently of robuster habit, the main stems being stout and of a deep horn-colour.

This species is one of the commonest and prettiest of the littoral Hydroids. Forests of its little plumes over-

spread the surface of the rock in the tidal pools, or invest the stems of the marine plants. So delicate is it, however, that it is often difficult to detect—its faint *shadow*, cast by the strong light of the summer day on the rock from which it springs, being often the only indication of its presence to the collector*.

The capsules are produced in the axils only, and often form a continuous row down the centre of the plume. The difference of sex is less marked than in many cases. The female capsule is of an elegant flask-like form, with a prolonged tubular neck terminating in an orifice sufficiently

* I recommend the following mode of proceeding to the hunter for minute zoophytes. Of course, I assume that he is equipped in garments which the old-clothesman would hardly covet, and that he is indifferent to appearances, as he will probably be if he is a true naturalist. Let him select a likely pool, one with overhanging ledges and clefts well draperied with weed, upon which the sun may happen to be shining, and then let him lie down at full length beside it, that he may be able to peer into it patiently and intensely, without the fatigue and distraction of *stooping*. He must prepare for some close and continuous looking—not merely running his eye over the bottom and the rocky walls, but scanning them carefully inch by inch, raising the curtain of hanging weed, and allowing the sunlight to pierce the chinks and crannies and illuminate their hollows, coloured by the brilliant sponge or the crust of the *Lepralia*, and teeming with varied life. He should bring his eye to the edge of the pool, and look *down* the side, so as to catch the outline of any zoophytes that may be attached to it amidst the tufts of minute algæ. He must not be content with a hasty glance, but look and look again until his eye is familiar with the scene, and may accurately discriminate its various elements. And let him watch for the *shadows*; for in following them he will often secure the reality. I have frequently detected the tiny *Campanulariæ* and *Plumulariæ* in this way, by means of the images of their frail forms, which the light had sketched on the rock beneath them. For tools, the hunter must have his stout, flat, sharp-edged collecting-knife, a long-armed and substantial forceps, and a varied array of bottles, ranging from the Homœopathic tube to the pickle-jar. If his choice of ground be good, and his patience proof, and his eye quick, he will have an ample reward for his labour in the rich spoil of beauty which he will bear away, even if he should not hit upon any novelty; but amongst the minute zoophytes there is still, I have no doubt, much to be done in the discovery of new forms, as there certainly is in working out thoroughly the history of those that are known.

wide to allow of the egress of the mature planulæ; the ova are arranged in lines, and form a compact mass, occupying the greater part of the cavity. The male is smaller, according to the general rule, and very slender, wanting the long neck, and with a minute orifice at the top* (Woodcut, fig. 34, *a*, male; *b*, female).

Fig. 34.



Hab. On weed, zoophytes, rock, &c., from the littoral zone to deep water; generally distributed.

Branched var. Malahide (Macalla): Cornwall (T. H.).

[On *Phallusia intestinalis*, at Messina (Sars): Belgium, on *Laminaria* (Van Ben.).]

3. P. CATHARINA, Johnston.

PLUMULARIA CATHARINA, *Johnst. Mag. Nat. H.* vi. 498, figs. 61, 62; *Brit. Zooph.* 97, fig. 1 (p. 3), fig. 17 (p. 98); *Agassiz, N. H. U. S.* iv. 358.

AGLAOPHENIA CATHARINA, *Gray, Cat. B. M. Radiata*, 81.

? SERTULARIA SECUNDARIA, *Cavolini, Pol. Mar.* (German tr.) 105, pl. viii. figs. 15, 16.

Plate LXVI. fig. 2.

SHOOTS clustered; *stems straight* or slightly curved, delicate, and pellucid; *pinnae opposite*, simple or pinnate, the pairs distant; HYDROTHERMÆ deep, with an even margin, separated by two joints, borne on the main stem as well as on the pinna; NEMATOPHORES tapering downwards, expanding into a wide-mouthed cup above,—one on each side of the calyces, pedunculated, and two or

* Sir John Dalyell, by a curious blunder, has treated *Plumularia setacea* as a portion of *Antennularia ramosa*, upon which he found it parasitic, and regards the “ampullate vesicles” as a second kind of reproductive body belonging to the latter zoophyte (*Rare and Rem. An. of Scotland*, vol. i. p. 205-9, pl. xxxix. figs. 9, 10).

three (sessile) in a line along the intervening internodes ; many distributed over the main stem and creeping stolon ; GONOTHECÆ springing from the base of the hydrothecæ ; (male) elongate-ovate, slender, tapering above and below ; (female) pear-shaped, operculated, with a two-jointed stalk, bearing two nematophores near the base.

THE salient character by which this exquisite species may be distinguished from all its British congeners is the arrangement of the pinnæ in exactly opposite pairs. This gives it a very distinctive habit ; and it has besides a peculiar delicacy and beauty of its own. The pinnæ slant upwards ; they are also set forwards on the stem, and the plumes have therefore the appearance of being partially folded. A little above the point of origin a single joint occurs ; and throughout the rest of the pinna the internodes which bear the calyces alternate with others on which two or three sessile nematophores are ranged in a line.

The lateral nematophores on the hydrothecæ exhibit a curious peculiarity : they are mounted on peduncles, by which they are raised nearly to the level of the rim, and are beautiful objects for examination with the microscope. There is an extraordinary profusion of these curious organs on this species, and they are present on the creeping stolon as well as on almost every other portion of the polypary.

The cup or bowl that surmounts the nematophores, and contains the thread-cells imbedded in a granular mass, is ample and patulous. I am not acquainted with any zoophyte in which their structure can be studied to more advantage.

The reproductive capsules bud from the portion of the pinna or stem immediately below the hydrotheca, between

the base of the eup and the adjoining nematophore. The male and female are dissimilar, and are intermingled not only on the same shoot but on the very same pinna. The female are relatively very ample. The oblique terminal aperture is closed by an operculum, which is not cast off, but remains attached at one point as by a hinge. The central column bears a single sporosae, which becomes terminal and occupies the upper portion of the cavity. One ovum, so far as I have observed, is produced in each. In the male, which is slender and comparatively small, a mass of close granular matter, corresponding in shape with the capsule, extends from the base to the top (Woodent, fig. 35).

Fig. 35.



P. Catharina grows in dense clusters, and attains a height of 3 or 4 inches.

A very curious and beautiful variety occurs in which the erect stem is wanting, and simple shoots, exactly resembling the pinnæ of the ordinary form, are given off directly from the creeping fibre. In this condition the entire aspect of the zoophyte is so completely changed that it might pass for another species. I have little doubt, indeed, that the obscure *Sertularia secundaria* of Cavolini is neither more nor less than the stemless form of *P. Catharina*, or of some kindred species; and the hydroid described by Dana* under the name of *Antennularia cyathifera* is evidently something of the same kind.

The creeping variety of *P. Catharina* is of a delicate citron-colour when living; it is found with reproductive capsules.

This species was named by Dr. Johnston in honour of his wife, to whom zoophytologists are under lasting obligations for the drawings (many of them could hardly be

* United States Exploring Expedition: Zoophytes.

surpassed in beauty) with which she enriched her husband's classical work.

Hab. On shells, corallines, and especially the tests of Ascidians, from deep water; generally distributed. Abundant and very fine in Shetland: Cornwall, plentiful; I have specimens overspreading the shells of *Pinna* from 60 fathoms: Arran Islands, west coast of Ireland (Barlee): Jersey (A. M. N.): Peterhead and Wick, on the fishermen's lines (C. W. P.): Oban (T. H.): off Sana Island, in 40 fathoms (Hyndman): coasts of Yorkshire, Durham, and Northumberland; Dublin Bay; Isle of Man (T. H.), &c. &c.

The stemless variety I have dredged off Ilfracombe, and found growing on *Sertularella Gayi*, from Cornwall: Peterhead (C. W. P.).

4. *P. ECHINULATA*, Lamarck.

PLUMULARIA ECHINULATA, *Lamk.* An. s. V. (2nd ed.) 162; *Johnst.* B. Z. 464, 465, fig. 80.

SERTULARIA SETACEA, *Lister*, Phil. Trans, 1834, 371, pl. viii. fig. 4.

Plate LXV. fig. 2.

SHOOTS very delicate; STEM *curved*, jointed, *the internodes rather short and attenuated downwards*, simply pinnate; pinnæ alternate, arching gracefully, one on each internode, with two joints immediately above the point of origin; HYDROTHECÆ *small and basin-shaped, moderately distant, separated by a single joint*; NEMATOPHORES very minute, eup-shaped, simple, adnate to the side of the stem, *one behind and above the calycle, one below it, and one (or sometimes two) in the axils of the pinnæ*; GONOTHECÆ *ovate, subsessile, with longitudinal spinous ribs*, borne profusely on the creeping stolon and the central stem.

P. ECHINULATA is commonly from $\frac{3}{4}$ to 1 inch in height.

Its plumes are very compact, slightly recurved, and somewhat wide. Dr. Johnston has exaggerated the amount of resemblance between it and *P. setacea*. Besides the differences in size and habit, and in the form and position of the capsules, there is a striking dissimilarity in the details of structure, in the shape of the calyces, the jointing of the stem and pinnæ, and the number and character of the nematophores. The latter in the present species are of the simple type, whereas in *P. setacea* they are compound, affording a very good illustration of the bithalamie form. The female capsule encloses a single large sporosae, containing many ova. The spinous processes, which form a crest upon the longitudinal ridges†, vary in the degree of development, and are sometimes of very considerable length.

Hab. On stone and weed, between tide-marks and in shallow water; not uncommon. It shows a decided preference for *Zostera marina* and *Chorda filum*.

5. *P. SIMILIS*, Hincks.

PLUMULARIA SIMILIS, *Hincks*, Cat. Devon & Cornw. Zooph., Ann. N. H. (ser. 3) viii. 257, pl. vii. figs. 3, 4.
 „ SETACEA, *Landsborough*, Pop. Hist. B. Z. pl. ix. figs. 26, 26*.

Plate LXV. fig. 3.

SHOOTS simple, slender, *white, or of a pale horn-colour, and attaining a height of about an inch and a half*; STEM jointed, *internodes long and of equal width throughout*; pinnæ alternate, one below each joint, set forward on the stem; HYDROTHECÆ *rather large, curving outwards towards the top, entire, very distant, always separated by two joints*; NEMATOPHORES minute, simple, *one below each calycle*; GONOTHECÆ *ovate, elongate, tapering below,*

† “Vesiculis cristato-serratis.”—*Lamarck*.

subsessile, smooth, *divided into seven or eight obscure lobes*, borne on the creeping stolon and the main stem.

THIS species is nearly allied to the preceding, from which, however, it differs in size and general habit, as well as in the minute characters.

The points in which it differs from *P. echinulata* are as follows. The plumes are longer, narrower, and less compact and graceful. The internodes of the stem are about half as long again as those of *P. echinulata*, and are of equal width throughout, while those of the latter species taper a little below. The hydrothecæ of *P. similis* are rather large, curving gracefully outwards towards the rim, and free above, with a wide circular opening, and are very unlike the small basin-shaped calycle of its ally; they are always separated by *two* joints, while in *echinulata* there is (normally) only one; so that the cells are distant in the one species, and comparatively crowded in the other.

In *P. similis* there is only a nematophore below the calyces, none above them or in the axils as in *P. echinulata*. And, lastly, the capsules are totally dissimilar.

Hab. South Devon, abundant on weed in the Laminarian zone; Isle of Man (T. H.): Donaghadee (G. Hyndman): Dublin.

6. *P. OBLIQUA*, Saunders.

LAOMEDEA OBLIQUA, Saunders, in litt.; *Johnst. B. Z.* 106, pl. xxviii. fig. 1.

CAMPANULARIA, Lister, *Phil. Trans.* 1834, 372, pl. viii. fig. 5.

PLUMULARIA OBLIQUA, Hincks, *Ann. N. H.* (3rd. ser) viii. 258.

Plate LXVII. fig. 1.

SHOOTS *minute*, simple and very delicate; STEM *flexuous*, jointed at regular intervals, pinnate; *pinnæ* given off at each flexure, alternate, *short*, bearing a single calycle, and

with two joints a little above the point of origin ; HYDROTHECÆ campanulate, *with a deeply sinuated rim* ; NEMATOPHORES minute, two immediately above and behind the calycle, one below it, one in each axil and on each internode of the stem ; GONOTHECÆ *very large, ovate, truncate above*.

THIS fairy-like species, which only attains a height of about a quarter of an inch, was ranked by Dr. Johnston amongst the *Laomedææ*. It differs from its British congeners in having only a single calycle on each pinna, and therefore wants the characteristic plumous form ; in all other respects (in the presence of nematophores, which are developed in great abundance, the structure of the stem, and the character of the hydrothecæ) it agrees with the genus *Plumularia*.

The polypite has about sixteen very short arms.

The reproductive capsule was figured by Lister in his remarkable paper in the ‘Philosophical Transactions;’ and nothing, I believe, has been added to his account of it. It is produced at the base of the pinnae, contains a single sporosac and is of remarkable size as compared with the calycles (Woodcut, fig. 36).

This minute species is rich in the elements of beauty. The slender flexuous stem, the graceful form of the hyaline calycle with its sinuated rim, nestling in the curved arm of the pinna, and the tenuity and transparency of the whole render it a singularly attractive object.

Fig. 36.



Hab. On weed &c. near low-water mark. So far as observation has gone hitherto, *P. obliqua* must be accounted a local species. It was originally discovered at Brighton, and appears to be common in the south-eastern district. It has occurred at a single point on the Cornish and South-

Devon coasts ; and I have found it in abundance under the ledges and in the pools near low-water mark on the Capstone at Ilfracombe : here it forms miniature groves on the sponge which coats the surface of the rock, or on the roots and stems of weed. It is also extremely common on the coast of Dorset, in Swanage Bay &c. Sidmouth, on *Rhytiphlæa* (Miss Cutler) : Cornwall (Couch).

[Van Diemen's Land.]

With compound stem.

7. *P. HALECIOIDES*, Alder.

PLUMULARIA HALECIOIDES, Alder, Ann. N. H. (ser. 3) iii. 353, pl. 12.

Plate LXVII. fig. 2.

SHOOTS about an inch high, *irregularly branched* ; STEM *compound* throughout a great part of its length, simple and very delicate towards the top, *very slightly zigzagged* ; *branches given off from different aspects of the stem*, compound towards the base, with three joints above the point of origin ; *pinnæ alternate, distant*, springing immediately below a joint, *short, often bearing only a single calycle, and never more than three or four* ; HYDROTHECÆ *very distant*, separated by two, or rarely three joints ; NEMATOPHORES very minute, with a somewhat oblique orifice, *one above and one below each calycle, and one on the central stem, above the origin of the pinna* ; GONOTHECÆ *large, ovate, ribbed transversely, with a broad truncated top*, and a very short pedicel, borne on the stem singly or in clusters.

THE branching of this singularly delicate and beautiful species has a certain constancy in its irregularity. It is almost always one-sided—a single branch, of preeminent size, springing from one aspect of the stem (or sometimes two or three), while the opposite is almost bare. In its mode of growth it is not unlike the genus *Halecium*. The

capsule resembles that of *Clytia Johnstoni*, and the form is unique amongst the *Plumulariidae*.

The polypites have about 20 tentacles when mature. Like others of their tribe they have the habit of throwing the arms back and allowing them to droop gracefully round the calycle.

Hab. On stones, and amongst sponge &c. covering the surface of the rock, near low-water mark. Cullerecoat, and elsewhere on the Northumberland coast, not common (J. A.): Roker, near Sunderland (Mr. A. Hancock): Shetland (Barlee): the Capstone, Ilfracombe, in the lower rock-pools (T. H.). In the last-mentioned locality it is not at all uncommon.

8. P. FRUTESCENS, Ellis & Soland.

SERTULARIA GORGONIA, *Pall.* Elenchus, 158.

„ FRUTESCENS, *Ellis & Soland.* 55, pl. vi. figs. a, A, and pl. ix. figs. 1, 2.

AGLAOPHENIA FRUTESCENS, *Lamx.* Cor. flex. 173.

PLUMULARIA FRUTESCENS, *Lamk.* An. s. Vert. (2nd ed.) ii. 166; *Johnst.* B. Z. 100, pl. xxiv. figs. 2, 3.

PENNARIA FRUTICANS, *Oken.* Lehrb. Nat. 94.

Plate LXVII. fig. 3.

ZOOPHYTE *irregularly branched, shrubby, of a black or dusky-brown colour, varnished; STEM tapering, composed of many delicate agglutinated tubes, the branches much and irregularly divided and subdivided into plumous shoots; pinnae approximate, crowded, alternate, bearing a branchlet a little above the point of origin, which is generally bifid; HYDROTHECÆ deep, almost cylindrical, adnate, with a slightly everted plain margin, from one to three on each internode; NEMATOPHORES funnel-shaped, the terminal cup wide and shallow, a pair behind and above the calycle, and one below it; GONOTHECÆ pear-shaped, shortly stalked, obliquely truncate above, with a very large operculated aperture, about three times the length of the calycle.*

P. FRUTESCENS rises from a fibrous base to a height of 5 or 6 inches. The main stem divides into a number of branched shoots, which give it a very bushy appearance. A marked peculiarity is the line of bifid ramuli, which is borne on the pinnæ parallel with the central stem.

Hab. On stones and shells, in deep water; rare. But few habitats for *P. frutescens* have been recorded, though it has a wide range. It is essentially a deep-water zoophyte, and seems to be cast ashore in small quantity. On the Yorkshire coast it is rare. It is occasionally obtained amongst the immense masses of zoophyte which a rough easterly gale flings on the sands at Filey; and Mr. Bean has dredged it at Scarborough. Mr. Alder reports it rare off the coasts of Durham and Northumberland. Oban (T. H.): Stenhaven, Kincardineshire (Lady Keith Murray): Shetland, Middle Haaf; Hebrides (A. M. N.): Cornwall, not rare (Couch): South of Ireland. [Algoa Bay (Krauss).]

Fig. 37.



Corbula of *Aglaophenia pluma*.

Suborder III.—GYMNOCHROA.

HYDRINA, Ehrenberg (in part), Corall. des roth. Meer. 67 ; Johnston, B. Z 121.

HYDRIDÆ, Huxley, Oceanic Hydrozoa, 20.

GYMNOTOKA (in part), J. V. Carus, Handb. d. Zoolog. ii. 562.

Family I.—Hydridæ.

Genus HYDRA, *Linnaeus*.

Der. From ὕδρα, the name appropriated to the fabled Lernaean monster.

GENERIC CHARACTER.—*Polypites locomotive, single, destitute of polypary, cylindrical or subcylindrical, with a single series of filiform tentacula round the mouth, and a discoid adhesive base. Gonozooids always fixed, developed in the body-walls.*

THE body of the *Hydra* is composed of a gelatinous and highly contractile substance, and is consequently liable to many changes of form. The interior is occupied by an ample cavity, which extends from one extremity to the other, and terminates above in a simple orifice or mouth. Around this are placed a variable number of contractile tentacles arranged in a single wreath. The base of the body expands into a kind of disk, by which the *Hydra* attaches itself to the stems and leaves of plants, and by means of which it can also glide slowly over their surface. It fulfils the contrasted functions of attachment and locomotion.

The tentacles are more or less extensile, and bear a formidable armature in the shape of numerous thread-cells, which are grouped together on small prominences or

nodules; they are admirable instruments both for the capture and destruction of prey. Worms and larvæ, Entomostraca, and even minute fishes constitute the food of the *Hydra*; and these are seized by the long, flexible arms, and probably paralyzed by the threads which are darted forth from the numerous batteries of thread-cells covering their surface. It has been noticed that worms which have escaped from the *Hydra*'s grasp usually die soon after, as if from the effects of some poisonous secretion.

The *Hydra*, which is little more than a locomotive stomach and feeding-apparatus, is remarkable for its voracity and activity in capturing prey, seizing a worm "with as much eagerness as a cat catches a mouse"*.

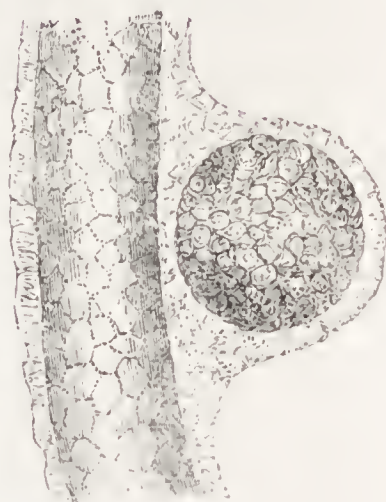
Like the rest of its tribe it is propagated in two ways, by gemmation and by a true sexual reproduction. In the earlier part of the year budding goes on rapidly, and large numbers of young pullulate from various parts of the body, which are developed into perfect polypites and finally become detached. This vegetative process is extremely productive: buds are often present on the young *Hydra* before detachment; and as many as four generations are sometimes organically united, so as to form a composite being. "We have thus in a transient stage of the life-history of the *Hydra* a representation of that which is the permanent condition of most of the hydroid zoophytes." Rarely, fissiparous reproduction occurs, the fission being either longitudinal or transverse.

At certain seasons, and especially towards autumn, true reproductive organs are developed, the spermary and ovary being usually present on the same individual, but borne on different regions of the body. The ovary is a simple sac, formed by a bulging of the body-wall; and

* Baker.

between its investing membranes the ovum is developed (Woodcut, fig. 38). After a time it bursts the ectodermal covering which confines it, and remains attached by a kind of pedicel. At this stage a very strong, elastic shell or capsule forms round the ovum, the surface of which is, in some cases, studded with spine-like points, in others tuberculated, the divisions between the tubercles being polygonal*. After a time the ovum drops from its pedicel and becomes attached by means of some mucous

Fig. 38.



secretion, in which state it remains until the liberation of the embryo. The young *Hydra*, on issuing from the egg, has four rudimentary tentacles (Woodcut, fig. 39). The ova are occasionally produced in spring, and in this case they are hatched in the course of the summer; but more usually they are developed late in the autumn, when gemmation has quite ceased, and undergo no change till the following year. The spermaries are developed as small conical projections, a little below the base of the tentacles (Woodcut, Fig. 40, *a*).

Fig. 39.



The *Hydra* may also be multiplied indefinitely by mechanical division; almost every portion, separated from the rest, is capable of producing a perfect polypite. It has even been observed to break up of itself into numerous particles, which lived on for a considerable time, and at

* *Vide* a paper "On the coexistence of ovigerous and spermatocapsules on the same individuals of the *Hydra viridis*," by Prof. Allen Thomson (Proc. Roy. Soc. Edinb. No. 30. 1847).

last, in some cases, became encysted; and it is not improbable that each of these fragments would ultimately give origin to a polypite.

The affinities of the *Hydridæ* are with the *Athecata*, and Carus includes them in this group; but the total absence of polypary, the locomotive habit, and the character of the reproductive organs seem to me to entitle them to rank as a distinct suborder.

The *Hydræ* are all inhabitants of fresh water. We know little of the geographical distribution of the genus; but it occurs in North America as well as in Europe.

For a detailed history of the *Hydra*, and an account of the curious experiments that have been made to test its powers of reparation and endurance, reference may be made to the classical 'Mémoire' of Trembley*, and to the works of Baker†, Rösel‡, Johnston§, Albany Hancock||, Laurent¶, Jäger**, and Ecker††.

1. *H. VIRIDIS*, Linnæus.

POLYPTES VERDS, *Trembley*, Mém. 22, pl. i. fig. 1, pl. iii. figs. 1-10.

HYDRA VIRIDIS, *Linn. Syst.* 1320; *Johnst. B. Z.* 121, woodcut. fig. 28.

„ VIRIDISSIMA, *Pallas*, Elench. 31.

Woodcut, fig. 40.

POLYPITES *grass-green*; body becoming gradually more

* Mémoires pour servir à l'histoire d'un genre de Polypes d'eau douce, à bras en forme de cornes. 1744.

† An Attempt towards a Natural History of the Polype. 1743.

‡ Insektenbelustigungen, Theil iii.

§ History of Brit. Zooph. i. 125.

|| "Notes on a Species of Hydra found in the Northumberland lakes," Ann. N. H. 1850.

¶ "Recherches sur l'hydre et l'éponge d'eau douce," in Vaillant's 'Voyage de la Bonite.'

** "Ueber das spontane Zerfallen der Süßwasserpolyphen, &c.," Wien. Sitz. 1860.

†† Entwicklungsgeschichte des grünen Ammpolyphen (*Hydra viridis*), 1853.

slender towards the lower extremity; *tentacles* 6–10, *shorter than the body*.

THE ovaries are developed in spring and summer (April to

Fig. 40.



June or July), and also in the autumn. Eeker has remarked that the eggs produced in the early part of the year run their course in the following summer, while those produced in the autumn pass the winter without change. The spermary and ovary are borne on the same individual, the former a little behind the tentacles, and the latter towards the lower part of the body. In the present species there seems to be usually only a single ovum.

H. viridis was discovered by Trembley in 1740.

Hab. Ponds and still waters; very common.

2. *H. vulgaris*, Pallas.

HYDRA VULGARIS, *Pall.* Elench. 30 ; *Johnst.* B. Z. 122, pl. xxix. fig. 2.

„ *GRISEA*, *Linn.* Syst. 1320.

„ *BRUNNEA*, *Templeton*, Mag. Nat. Hist. ix. 417, fig. 56.

Woodcut, fig. 41.

POLYPITES *orange-brown*; body cylindrical; *tentacula* 7–12, *rather longer than the body*.

THERE seems to be some variableness in the colour; a

Fig. 41.



bright red variety occurs occasionally, and Mr. Albany Hancock has noticed a flesh-coloured variety in the North-umberland lakes. The tentacles are rather numerous, and have none of the remarkable extensibility which characterizes those of the following species.

The number of eggs produced by a single polypite at once seems to range from four to seven.

Hab. Ponds and streams; common.

Var. *rubra*, Putney Heath, near London (J. E. Gray): ponds on Wimbledon Common (G. H. Lewes).

[The Hague (Trembley).]

3. H. OLIGACTIS, Pallas.

"LONG-ARMED FRESHWATER POLYPE," *Ellis*, Corall. 16, pl. xxviii. fig. C.

HYDRA OLIGACTIS, *Pall.* Elench. 29; *Johnst.* B. Z. 124, woodcut, fig. 27.

„ FUSCA, *Linn.* Syst. 1320.

„ VERRUCOSA, *Templeton*, Mag. Nat. Hist. ix. 418, fig. 57.

Woodcut, fig. 42.

POLYPITES brownish; *the lower part of the body suddenly attenuated, so as to form a kind of peduncle; tentacula 6-8, capable of great extension, to several times as long as the body.*

THIS species is known at once by the slenderness of the

Fig. 42.



inferior portion of the body, which has the appearance of

a stem or pedicel. It is traversed by a narrow canal, which terminates below, according to the observations of Baker, in a small opening. The arms are comparatively few in number, but are amazingly extensile.

This is a very beautiful and interesting species, and apparently less common than the preceding.

Hab. Still waters; rare: near London (Mantell): near Belfast (Templeton): the Avon, Guy's Cliff (T. H.).

4. *H. ATTENUATA*, Pallas.

HYDRA ATTENUATA, *Pall.* Elench. 32; *Johnst.* B. Z. 123, pl. xxix. fig. 1.

„ *PALLENS*, *Turt.*, *Gmel.* iv. 692.

POLYPITES “light oil-green, the body attenuated below, with pale tentacula longer than itself” (*Dr. Johnston*).

H. ATTENUATA, according to Johnston, is larger than *H. vulgaris*, and “of a more gracile form. Its colour is a dilute olive-green, with paler tentacula, which are considerably longer than the body, and hang like silken threads in the water, waving to and fro without assuming the regular circular disposition, which they commonly do in the *H. viridis*.”

I know nothing of this species. Fleming ranked it under *H. vulgaris*; but Johnston, after “long, continuous observation of individuals in confinement,” was convinced of its distinctness.

Hab. Yetholm Lough, Roxburghshire (*Johnston*).

APPENDIX.

Family Podocorynidæ.

[*Vide* page 27.]

Genus PODOCORYNE, *Sars* (in part).

3. P. PROBOSCIDEA, n. sp.

Plate XXIII. fig. 4.

POLYPITES tall and rather stout, of an orange-brown colour, with a very long and somewhat columnar, opaque-white proboscis, and about 14 tentacles, some of which are tall and erect, and others short and borne at right angles to the body; GONOPHORES forming a large collar round the polypite, at a short distance below the tentacles, disposed in two rows, and borne on small tubercles, ovate, red and purplish.

GONOOID.—In the specimens which I have examined, and which were obtained in the month of September, the gonozooids had all the appearance of being imperfectly developed, and never became free. The umbrella and the radiating canals were visible through the investing capsule; and round the free margin of the former were eight short conical tentacles (four larger and four smaller), bearing a patch of dark-brown colour near the base. The cavity of the umbrella was occupied by an orange mass, with the upper extremity always of a purplish colour. This mass gradually increased in size, and passed beyond the opening of the umbrella, but was still enclosed by the ectotheca. The development was not traced further; but I have little doubt that this was

the spermary, and that the zoophyte was in the depauperated condition which marks the close of the breeding-season*. Earlier in the year the gonozooids would probably become free, and mature their products after liberation. In one instance, and in one only, the contractile movement of the umbrella was observed.

P. PROBOSCIDEA is a larger species than *P. carnea*, and is known at once by its long, cylindrical, and very conspicuous proboscis, which is opaque-white in colour, and has the appearance of being fluted down the sides. The tentacles, which are less numerous than in the last-mentioned species, are ranged in two semialternating rows—one erect and of considerable length, the other short, standing out from the body, and placed a little behind the primary set. When contracted they become very thick, and almost leaf-like in form.

The gonophores are borne at a very short distance below the tentacles, and form a double ring round the body. They are supported on small tubercles, and sometimes number nearly a dozen. There is no apparent difference between the prolific and the barren polypites.

The exact nature of the adherent base was not determined; but the polypary encircles the lower extremity of the polypites.

Hab. On Laminaria-roots, and on stones in rock-pools, Capstone, Ilfracombe.

Family Corynidæ

Genus CORYNE, Gaertner.

To the synonyms of this genus must be added the *Halybotrys* of Filippi. In a paper presented to the Royal Academy of Turin, so recently as 1865, this author has proposed the above name for a Mediterranean Hydroid, which is nothing more or less than a very ordinary member of the old and well-known genus *Coryne*.

* Vide the account of *Syncoryne gravata*, p. 54.

CORYNE PUSILLA, Gaertner.

[*Vide* pp. 39, 40.]

THE *Stipula ramosa* of Sars was referred with doubt to this species before I had seen the figure of it in the ‘*Söedyrenes Naturhistorie*.’ After examining that figure I have no hesitation in placing it amongst the synonyms of *C. pusilla*.

The male gonophores in this genus seem to be always pointed above, while the females are spherical.

Genus SYNCORYNE, *Ehrenb.* (in part).

SYNCORYNE PULCHELLA.

[*Vide* p. 57.]

Plate XV. fig. 3.

I HAVE obtained this species on Laminaria-roots from the Capstone at Ilfracombe, and am thus enabled to give a figure of it and to add some particulars to Prof. Allman’s description.

The polypites are long, of nearly equal width throughout, with about 20 very short and thick tentacles, the capitula of which are scarcely broader than the arm itself. Those of the uppermost or oral verticil, consisting of four, are much the largest, those of the lowest are only about one-third the size. The stem tapers downwards.

There are three gonophores in each cluster, and sometimes two clusters on a polypite, sometimes only one.

SYNCORYNE FEROX, T. S. Wright.

CORYNE FEROX, *Wright*, Journ. Anat. and Physiol. i. 335.

STEMS single, smooth; POLYPITES with thick, short tentacles, having the capitula scarcely larger than the width of the tentacle; GONOPHORES borne beneath the tentacles. GONOOID similar to that of *S. decipiens*.

A FULLER description were much to be desired.

This species is nearly allied to the *S. decipiens*, but

differs from it "in its more robust and clumsy habit." The chief peculiarity lies in the tentacles, which are short and nearly of equal thickness throughout; "and though they are surmounted by a cluster of thread-cells, the thread-cells are so few in number that the tentacles can scarcely be termed capitate."

The present species, according to Dr. Wright, is much less hardy than *S. decipiens*. The latter will live for several years in captivity, whereas *S. ferox* "seldom survives more than a few days after having been removed from the sea." Dr. Wright does not give the number of tentacles, nor does he tell us whether the gonophores are clustered or not. It is not improbable that this species may prove to be identical with the *S. pulchella* (Allman).

Hab. Firth of Forth. "It inhabits, generally, crannies in large shells tenanted by Hermit-crabs, and rarely the hollows of stones found in pools at extreme low-water mark" (T. S. W.).

Family Clavatellidæ.

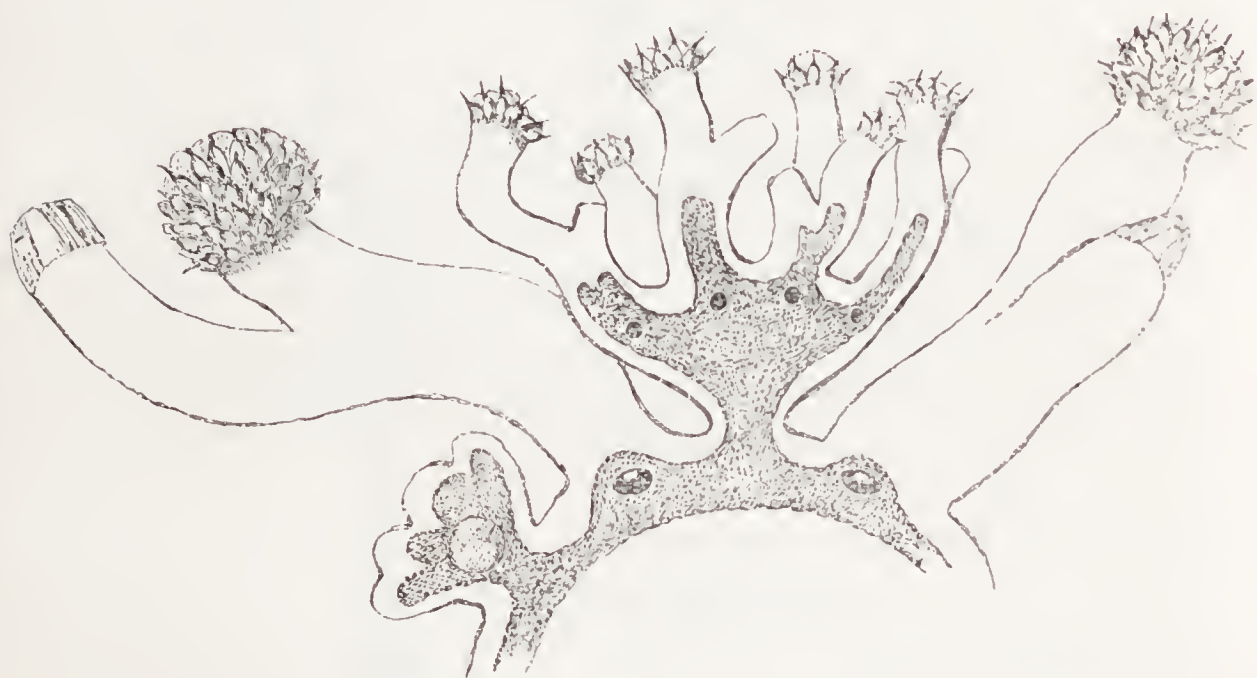
Genus CLAVATELLA, Hincks.

Prof. F. DE FILIPPI, of whose paper on *Eleutheria* I had only seen a brief abstract when the account of this genus was written, is very confident that one of the forms described by Claparède under that name is specifically distinct from *Clavatella prolifera*. The mere variation in the number of tentacles is not a point of any importance; for individuals agreeing in having six radiating canals have been found with 8, 7, and 6 arms. But Claparède met with specimens having only four radiating canals, and Filippi says that this character is associated with a difference in general form and in some points of internal organization. If so, Claparède's zoophyte may be the sexual zooid of another species; but it would be satisfactory to have the opportunity of examining the polypites before coming to a decision. It is not a little remarkable that

the polypites of this family should have eluded the observation of so many excellent naturalists. Prof. Filippi tells us that in his aquaria, towards the middle of April, the free zooids of *Clavatella prolifera* were present “in numero incaleolabile;” yet he seems never to have traced them to their stock.

The polypite is minute and exceedingly slender; but when extended, its milk-white colour makes it easy to detect in a good light. It is very limited in its habitat;

Fig. 13.

Gonozoid of *Clavatella*, with young budding.

and the small clean pools, on the higher rocks between tide-marks, in which it delights are readily examined. It is not a denizen of such as are thickly overgrown with weed. Coralline, and a delicate bright-green alga which grows in small tufts, constitute the chief vegetation of the haunts of the *Clavatella*.

It loves the freshest and purest water, and, frail as it seems and is, it is found amidst the tumultuous dash of the waves on the most exposed portions of the coast. When contracted, the body shrinks down amongst the algæ, or

into some cranny in the rock, and the arms are reduced to mere knobs. (Woodeut, fig. 44 *b*).

It is difficult to understand why Prof. Filippi applies the name *Eleutheria* to the gonozooid of *Clavatella*. He admits that the latter is generically distinct from Quatrefages's zoophyte, yet ranks it under his name! *Eleutheria* should be restricted to the form described by the French naturalist; the species bearing arms with dissimilar branches must be referred to *Clavatella*.

Filippi has frequently seen gemmation commencing on the young zooid before its separation from the parent, just as in *Hydra*, so that three generations were for the time organically united. The number produced by budding must be immense. (Woodeut, fig. 43.)

Fig. 44.



Family Tubulariidæ.

Genus TUBULARIA, Linnæus.

T. INDIVISA, Linnæus.

I HAVE not included the *T. calamaris* of Van Beneden amongst the synonyms of this species. The description of it does not agree in some points with *T. indivisa*; and Mr. Alder, who had examined specimens supplied by Van

Beneden, felt doubtful as to the identity of the two. The following is his note on *T. calamaris* (Van Ben.) :—" This is not above half the usual size of *T. indivisa*, and of a paler colour. It has rather the aspect of a different species; but I should not like to decide without seeing something further of it."

Genus CORYMORPHA, Sars.

C. NUTANS, Sars.

[*Vide* p. 129.]

THE small specimen of *Corymorpha* obtained at Fowey Mr. Alder regarded latterly as distinct from *C. nutans*. He had also found a species at Douglas, Isle of Man, which he thought might be the *C. Sarsii* of Steenstrup. It is not improbable that the other Norwegian species will be obtained on our shores.

Family Lafoëidæ.

Genus FILELLUM, Hincks.

THE chitinous crust assigned to this genus is a very doubtful character. In young specimens, and those which are developed on shell, there is certainly no trace of anything of the kind. Where the zoophyte spreads over the stems of *Sertulariæ*, and the calyces are densely crowded together, it has a spongy appearance; but it is difficult to say whether this is due to the presence of a "crust" or to some other cause.

The Australian genus *Lineolaria* (Hincks), so far as the polypary affords the means of judging, seems to be nearly related to *Filellum*. It is furnished with spinous, recumbent capsules.

Family **Haleciidæ**.Genus **HALECIUM**.**H. BEANII**, Johnston.

ON Plate XLIV. fig. 3 an *Halecium* is represented which was obtained by dredging off the Isle of Man, and which I at one time considered a distinct species. I am now inclined to regard it as only a peculiar condition of the well-known *H. Beanii*. The capsules are for the most part pyriform, but occasionally elongate, with a slight depression at the summit. They are borne at the extremity of the lateral stem-processes, in the position usually occupied by the calyces. In these particulars the Isle-of-Man specimen differs from *H. Beanii* in its ordinary condition; and as it was thickly covered with the yellowish pear-shaped capsules, it presented a very distinctive aspect. The calyces, however, exhibited no peculiarities, and I therefore merely direct attention to the variation in the form and position of the reproductive bodies.

SUPPLEMENT TO APPENDIX.

Family **Clavidæ**.**CORDYLOPHORA LACUSTRIS**.

[*Vide* page 16.]

I HAVE been favoured by Mr. W. Madeley, of Dudley, with the following additional habitats for this species:—

On a piece of an old boat in the canal at Tipton; on an old boat in the Stourbridge canal, not far from Dudley, plentiful.

Family Corynidæ.

Genus CORYNE, Gaertner.

Additional Species.

C. NUTANS, Allman.

In Norman's Shetland Dredging Report, Brit. Ass. Rep. 1868 (1869).

“TROPHOSOME.—HYDROCAULUS [stem] attaining a height of about four lines, much branched; branches subalternately disposed, deeply and distinctly annulated, the annulations of hydrocaulus [stem] becoming less distinctly marked towards the base; POLYPITES *depressed on one side of the stalk, so as to assume a nutant posture, ovate, with about 15 tentacles.*

“GONOSOME unknown.”

PROVISIONALLY referred to the genus *Coryne* in the absence of the gonozooids.

Hab. Shetland (Jeffreys and Norman).

Fig. 45.



Plumularia setacea.

LIST OF WORKS ON THE HYDROIDA.

ELLIS. Essay towards a Natural History of Corallines. 1755.

PALLAS. Elenchus Zoophytorum. 1766.

Amongst the older authors these two stand preeminent,—the former for the closeness of his observation, and his simple truth to life both in his drawings and descriptions, the latter for his admirably accurate and graphic diagnosis.

Ellis, following the lead of Peyssonel (1727), was mainly instrumental in establishing the animal nature of the Zoophytes.

CAVOLINI. Memorie per servire alla storia dei Polipi marini. 1785.

This work is replete with interesting observations.

LAMOUREUX. Hist. Pol. flexibles. 1816.

———. Exposition Méthodique, &c. 1821.

LAMARCK. Animaux sans Vertèbres, vol. ii. 1816.

LISTER. Philosophical Transactions for 1834.

SARS. Bidrag til Sördyrenes Naturhistorie. 1829.

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ERRATA.

Introduction, page xxii, line 5 from the bottom. For *Clava* read *Coryne*.

Page 2, line 17 from the top. For *Skagarack* read *Skager Rack*.

Page 35, line 10 from the top. For *Eudendriidæ* read *Atractylidæ*.

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[Synonyms are in *Italics*.]

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